For many reasons it is preferable to publish the information and scientific work of the Light Institute in a collected form and not, as has been the case up to now, scattered in various journals, and therefore a series of “Communications from Finsen's Medical Light Institute” shall be started with the present issue.

How these communications will usually be made is best seen from the task, or rather from the tasks, which the Institute has set itself. The first and most essential task is the investigation of light and its effects, because this is the only way to create a healthy and solid basis for the second task of the Light Institute, namely: the use of light in medicine. The first task requires investigations of a physical, chemical, and biological nature; the second task requires practical medical examinations, experiments in various diseases. Of course, works will also appear that are in a different area, but that are somehow connected with the effectiveness of the institute. On the other hand, work that does not come from the institute itself, but that touches on a special area, can also be included in these communications. It is also intended to be critical

Finsen's Medical Lys Institute.

(Finsens Medical Light Institute).

In April 1896 a circle of gentlemen met here in Copenhagen together, partly by university professors of the medical faculty and eminent physicians, partly by men of great influence, whose names are given below, in order to create the external conditions for a thorough study of the effects of light, with special reference to their importance for medicine. – The reason for this was my investigations into the physiological effects of light, and especially my proof of the powerful influence of light on the course of smallpox, as well as a case of lupus vulgaris, which I had cured by concentrated chemical rays of light.

It has now been decided to set up a public, independent institution called "Finsens medicinske Lysinstitut", whose task according to § 1 of the statute is "to carry out and promote investigations into the effects of light on living organisms, mainly for purposes of using rays of light in the service of practical medicine".

The administration of the Light Institute consists of a senior management and a business committee. Form the senior management

Finsens Medical Light Institute.

14 gentlemen, namely the founders of the institute, namely the gentlemen Mayor BORUP, President; University professor of pathological anatomy Dr. medical CARL LANGE, Vice President; Director of Municipal Hospitals Judicial Council GREDSTED, Secretary; Factory owner cand. polyt. Wilh. JÖRGENSEN, Treasurer; University Professor of Anatomy Dr. medical CHIEVITZ; Senior Physician at Öresund Hospital Professor FEILBERG; Factory owner cand. polyt. HAGEMAN; Senior Physician at the Municipal Hospital Professor Dr. medical HASLUND; Manufacturer cand. polyt. JUHLER; engineer NIELS MOGENSEN; University professor of general pathology Dr. medical CJ SALOMONSEN; Supreme Court Advocate Senator WASSARD and Director of the Municipal Enlightenment Service WINDFELD-HANSEN. The Business Committee consists of Messrs. Factory owner HAGEMANN, President, Judicial Counselor GREDSTED, Professor HASLUND, Factory owner JÖRGENSEN, Engineer MOGENSEN and Professor SALOMONSEN. In scientific, medical terms, the institute is headed by the undersigned.

Thanks to a great deal of kindness from various quarters, a home for the institute was established. The Copenhagen Municipality donated a building site in the immediate vicinity of the "Commune Hospital" and also offered to provide the institute with electricity and all other equipment from the hospital for the time being. The Carlsberg Fund granted a sum of 2500 crowns for the establishment of the laboratory, and the two gentlemen mentioned above, GA HAGEMANN and WILH. JÖRGENSEN, provisionally advanced the funds for the construction of a building, which was tackled immediately, and scientific work began as early as August of the same year. At the end of the year, the gentlemen mentioned donated the entire building sum to the institute. However, after a year the listed building proved to be too small and it was closed in 1897

with the help of a government subsidy of 20,000 crowns, a new and much larger building was erected, like the first, made of wood and glass, in the manner of a studio. While the first building originally contained both a laboratory and an experimental clinic, it was now made entirely into laboratories and the new building housed the clinic only. In addition to these buildings, sun baths, stables for animals, etc. were built.

These buildings have long been insufficient, and the work of the institute has suffered greatly from this deficiency; but the conditions will soon improve, as the institute acquired a large property, which will be prepared in a short time to accommodate a laboratory, while a clinic must be specially built. It is also possible that the institute will receive a large amount of state aid this year, in that a sum of 240,000 crowns will be given to the light institute as an interest-free loan, in accordance with the proposal in this year's finance law.

Simultaneously with these explanations about the origin and the external conditions of the institute, I will give some information about the internal arrangements and work of the institute. As mentioned above, the Light Institute consists of two departments: the laboratory and the clinical department, which are of course closely related and mutually supportive.

The Clinical Department deserves a special mention, and a few figures from this best explain the extraordinary growth of the Light Institute over the past 2'2 years. In this period of time a total of 333 patients have been treated with concentrated chemical rays; 244 of them are lupus vulgaris, 89 cases of other skin diseases as an experiment (the indication for this treatment is superficial, local, bacterial skin diseases). These patients are distributed as follows over the elapsed time: in 1896 15 patients, in 1897 97 patients, in 1898 221 patients. In addition to these, about 30 patients have been treated experimentally with photochemical baths.

The staff of the institute has been increased in the same proportion. Now, at the end of 1898, it consists of 7 physicians, 1 physicist, 1 electrician and 33 nurses, as well as subordinate personnel. The physicians presently employed at the laboratory are: Messrs. S. BANG, VALD. BIE and V Sum; at the clinic: H.FORCHHAMMER, AXEL LARSEN and EILSCHOU HOLM. dr BANG is head of the laboratory, Dr. FORCHHAMMER Head of the clinic. Our physics collaborator is Mr. cand. mag. ABSALON LARSEN. Among our employees I can also mention Dr. medical Add HOLGER MYGIND, who has kindly offered the Light Institute his help with the quite numerous laryngological ailments presented by patients with lupus vulgaris.

So far *) the following communications have come out of the Light Institute, partly in the form of treatises, partly as lectures or demonstrations; I name them in chronological order: NIELS R. FINSEN: Om Anvendelse of koncentrerede, kemiske Lys

straaler i medicines. (On the use of concentrated chemical light rays in medicine). Copen

hagen Dec. 1896. (Gyldendals Publishing House). S. BANG: On treatment of Lupus vulgaris with concentrated Lys.

Forward with demonstration of the patient in front of the alm. Danske Lägemode i Fredericia. (On the treatment of lupus vulgaris with concentrated light. Lecture with demonstrations by patients at the general verse. Danish doctors in

Fredericia. August 1897). NIELS R. FINSEN: Le traitement du lupus vulgaire par les rays chimiques concentrés.

La semaine medicale 22 Decbr. 1897. VALDEMAR Bie: Om Virkningen of Spektrets forskellige Afdelinger

couple of bacteria. (On the action of the different departments of the spectrum on bacteria). Submitted by Prof. SALOMONSEN in the Society of Sciences on April 15, 1898. Oversigt over det royal danske Videnskabernes Selskabs Forhandlinger 1898, No. 2, p. 29. (Overview of the negotiations of the royal dan. Ge

Society of Sciences 1898, No. 2, p. 29). S. Bang: The Finsensche light therapy. Monthly magazines for practical

Dermatologie, Vol. XXVII, 1898. S. BANG: Results of Lupusbehandling med koncentrerede ke

Miske Straaler. (The results of treating lupus with concentrated chemical rays). Lecture with demonstration at the 6th Scandinavian Naturforscherkon

gress in Stockholm, July 1898. VALDEMAR BIE: Om Lysets Virkning paa Mikroorganismer. (Above

the effect of light on microorganisms). Paper presented at the 6th Scandinavian Naturalist Congress in Stock

Holm, July 1898. S. BANG: Traitement du lupus par les rays lumineux concentrés, d'apres la method du professor Finsen. lecture on

the 4th Tuberculosis Congress in Paris. Aug. 1898. Niels R. FINSEN: Aarsberetning for Finsens medicinske Lysinstitut.

(August 1896 to December 1897). (annual report) Septbr.

1898. H. FORCHHAMMER: Results of Lupus treatment paa Finsens

Medical Lys Institute. (The results of lupus treatment at Finsens medicinske Lysinstitut). Lecture and demonstration by (approx. 50) patients in the medical society in Copenhagen d. Nov 15 1898

NIELS R. FINSEN: La Phototherapy.

Contents: I. Les rayons chimiques et la variole. II. La lumière comme agent d'excitabilité. III. Traitement du lupus vulgaire par les rays chimiques concentrés (Carré et Naud), Paris 1899.

Niels R Finsen.

*) From January 1899 to May 1900 the following was published:

NIELS R. FINSEN: On the use of concentrated chemi

cal light rays in medicine. Leipzig 1899. (Vogels

Publisher. NIELS R. FINSEN: On the importance of chemical rays

of light for medicine and biology. Leipzig 1899.

(Vogels Verlag.) (German edition of "la Photothérapie.) NIELS R. FINSEN: Meddelelser fra Finsens medicinske Lysinstitut II

(Notices from Finsens medicinske Lysinstitut II) Copenhagen. December 1899. (Gyldendals Verlag.) Contents: I. SOFUS BANG: Om Lysets Virkninger paa Mikrober.

I. Variations in Modstandsevnen hos B. prodigiosus
efter Kulturens Alder og Temperature (About the
Effects of Light on Microbes, I Variations in
of resilience in B. prodigiosus after

age and temperature of the culture.)
II. ABSALON LARSEN: Actinoskopet (The Actinoscope.)
III. ABSALON LARSEN: Et photometer (A photometer.)
VI. ABSALON LARSEN: Om Buelyset's Variation med Strom

og Spænding. (On the variation of arc light

with current and voltage.) SOFUS BANG: Om Lysets Virkninger paa Microber. (About the we

effects of light on microbes). Lecture at the Biological Society in Copenhagen.

VALDEMAR BIE: Remarks on Finsens Phototherapy. The British

medical Journal, Sept. 30, 1899. VALDEMAR BIE: Finsens Phototherapy. The Philadelphia medical Journal, October 7, 1899. VALDEMAR BIE: Professor NR Finsen's light therapy. magazine for electrotherapy and medical electrical engineering, November 1899. VALDEMAR Bie: Finsen's phototherapy. Therapeutic Monthly Bulletins January 1900, VALDEMAR Bie: Finsen's phototherapy. The medical week 1900, no. 3, January 29.

II.

New studies on the Einwir effect of the light on the skin

from

Niels R Finsen.

I

In several of my previous papers I have the

Effects of light on the skin, partly mentioning the various works in this area (CHARCOT, WIDMARK, HAMMER, UNNA, MAKLAKOFF, DEFONTAINE, WEDDING) and partly communicating my own investigations. Therefore, I will not go into a general description of the effects of light on the skin here, but will confine myself to reporting and discussing a few experiments in more detail, which have partly confirmed earlier investigations and partly made new observations.

In December 1896 we began working in the Light Institute with a very powerful electric arc lamp (of 80 amps).

1) FINSEN: Om Lysets Indvirkninger paa Huden. hospital stays. 5th July

1893.

Om de kemiske Straalers skadelige Virkning paa den dyriske

organisms hospital stays.

1893.

Les rays chimiques et la variole. La Semaine medicale.

June 30, 1894.

1. Nou

join. Their light intensity may be struck at a little over 40,000 standard candles; for comparison, the electric arc lamps used to illuminate public places in large cities usually have a luminous intensity of 2-4000 standard candles.

At first, when we made experiments with the light of this lamp, and before we had learned to be careful, it greatly affected our skin and our eyes, and we all got to feel the strength of the light seriously at one time or another; especially on the day after the experiments, the skin on the face and neck was burning warm, red and sensitive to the touch, the conjunctiva was heavily injected, one had the feeling of grains of sand in the eyes and was afraid of light. Fortunately, inflammation of the inner parts of the eye did not occur, as we always wear all-black colored glasses when we need to see the arc.

In order to investigate various circumstances concerning this photo-inflammation of the skin, and especially to learn how much part the different kinds of rays had in this inflammation, I made the following experiments on my left forearm.

The principal reason why I made my own arm the subject of my experiment was for the practical reason that observation could be made through it at any time.

For the sake of accuracy, I must first state that the skin of my arm was quite white and unpigmented, and that the arm was covered by clothes every day.

Moreover, since I used the flexor side of the forearm where the skin is thin, I had an excellent light-sensitive and convenient subject for the experiment. The task now was to expose this skin to the strong light of the 80 amp lamp in such a way that certain parts of the skin are affected by all the rays, while other parts of the skin are only affected by certain parts of the spectrum. With this intention I placed on my arm a rock-crystal plate, a series of differently colored pieces of glass, some letters and stripes painted with ink, and an ointment, the protective effect of which I wanted to examine. All these things and colors were placed on the arm in such a way that the skin surrounding each figure was unrestrictedly affected by all rays of light; for in this way one could most easily observe, by way of comparison, the effect of each individual covering object. After the various items on the arm were arranged - the rock crystal plate and the glass pieces glued on with a small drop of fish glue, it was photographed before being exposed to the light

became. Above I bring a copy of the photograph; then one sees up on the arm, near the elbow joint, a round plate of rock crystal (19/2 mm thick), followed one after the other by 5 oblong pieces of glass (2 mm thick); that nearest to the rock-crystal plate was red, the second yellow, the third green, the fourth blue, and the fifth was an ordinary uncolored piece of glass. The first thing you can see on the skin is a strip of the applied ointment. In addition, one sees two letters NF painted with ink, and also a stripe (a bridge), also painted with ink, between the various pieces of glass.

The arm thus furnished was then exposed to the light of the 80 amp lamp, the intensity of which was controlled by an ammeter. The experiment was made on the evening of May 11, 1897, and lasted from 8:14 to 8:34.

The arm was held at a distance of 50 cm from the arc, in the most favorable position for the light, ie at an angle of 450-500 to the long axis of the carbons. Furthermore, the arm was held in such a way that the light hit the skin as perpendicularly as possible.

Since the lamp warmed up quite strongly, and the experiment would have failed if I had burned my arm, after 10 minutes I moved it away from the arc at a distance of 75 cm, and held arm 10 at this point again minutes. Then the pieces of glass were removed and the ink was washed off the arm. The skin showed up a little red right away. Also on all the covered areas and the same red everywhere. On inspection at 10.20 a.m. the same evening the redness had diminished somewhat and the skin was still uniformly colored throughout. On inspection after an hour, at 11 o'clock, the redness had increased again, but only in the places which had not been covered, but the difference was still very slight, and my test-book only mentions that the two letters are very indistinct to recognize

were.

The next morning, on the other hand, the result could be seen in sharp lines on the skin. This was now all dark red and warm and somewhat, but not very, sensitive to the touch.

lich. Wherever the skin had been covered with ink during the experiment, it now appeared quite white and normal and stood out sharply against the red surroundings, the two letters appeared very clearly white on a red background. - Where the ointment had been, the skin was also white, as was where the 5 pieces of glass had been, in that 5 white streaks of the same irregular shape of the pieces of glass were visible, and the skin of the same was quite normal to look at. On the other hand, the skin where the rock-crystal plate had been placed was entirely the same color, and was as hot and tender as on the uncovered parts. On the other hand, the place where it had been was clearly indicated by a white ring, for the rock-crystal plate had not been ground down at the edge, and this uneven edge had scattered the light in all directions, thereby preventing it from affecting the skin. There were also two patches of almost normal white skin in the middle of where the rock crystal plate had been, I didn't immediately understand their origin, but comparing it with the photograph I had taken beforehand, I saw that the isinglass was to blame, with what the plate was stuck; the dab of glue may have been a little thick, but in any case it blocked the light from making a visible effect on the skin. With regard to the glass plates, on the other hand, fish glue played no role, as can be seen from what has been said above. The skin was no matter where the little blobs of glue had been and where the glass alone had covered the skin.

The reddening of the skin lasted severely for a few days and then gradually decreased. The accompanying photograph, which shows how distinct the effect was, was taken at 3 o'clock on May 13th, ie 2 days after the exposure to the light. The photograph is taken on an orthochromatic plate, as the color nuances did not come out quite clearly on an ordinary plate. When the redness was almost gone, the skin began to peel off in the form of tiny flakes, like bran. The peeling lasted several days (from May 20-26). The skin was then very pigmented and the markings visible in the photograph now stood out, if possible even more clearly, as white on a brown background. was due to the ultraviolet rays, as well as that the visible chemical rays had produced no effect.

I noted that at the beginning of August (2', month later) one could clearly read the two letters on the arm. By October the letters were no longer visible, but the white stripes formed by the pieces of glass could be discerned, albeit indistinctly.

The experiments reported here coincide in individual points with two earlier experiments, namely by WIDMARK) in Stockholm and by myself. WIDMARKS beautiful

1) WIDMARK: Hygiea, hard tape no. 3.

A series of experiments, which I have repeatedly mentioned before, and by which it was scientifically proved for the first time that it is the ultraviolet rays of light which produce the light erythema, showed how far different the effect of the light is when it has passed through glass, and when it passed through rock crystal, obtaining in none of his numerous experiments a photochemical effect on the skin if the light had passed through a glass plate. It is well known that a sheet of glass absorbs most of the ultraviolet rays, while a sheet of rock crystal lets them through. My experiment has therefore fully confirmed the correctness of WIDMARK's results.

In addition, this attempt partly coincides with an attempt I made !) a few years ago. I had drawn an ink belt on the arm and then exposed it to the sunlight for 3 hours; as a result the skin became red and inflamed all over, only where the black color had protected was there a belt of white and normal skin. After a few days the redness disappeared and the skin was now pigmented all over where it had been red and inflamed. I then again exposed the same arm to the sunlight, but without ink, and now the white girdle of the skin became inflamed, while the pigmented surroundings remained unaltered. - Through this experiment I demonstrated the importance of skin pigment as a protective agent against the rays of light, and thereby the often disputed question as to the cause of the black color of the negroes was answered. - I have mentioned this earlier experiment in detail because I find it interesting to provide comparisons between the effects on the skin in both cases place. A comparison can namely be allowed here that it is the same skin, even the same arm, that has been exposed to two different types of light. I emphasize this in order to draw attention to the fact that there are such great individual differences in the reaction of the skin to the effects of light that a comparison between two different people would not be correct,

But back to business, the inflammation which appeared on my skin after exposure to sunlight for 3 hours (the experiment was made from 12 to 3 p.m. in the first half of August) was not as severe as that which appeared after the Exposure to electric light (an 80 amp lamp, distance 50-75 cm) for 20 minutes appeared. This superiority of the electric light is certainly of great importance in practical terms - for light therapy, however, it must be remembered that one cannot conclude from this that the electric light was over 9 times as strong as sunlight, one can only say that that it was over 9 times as rich in ultraviolet rays.

My experiment also showed in a very convincing manner the difference between the action of heat rays and chemical rays on the skin. The heat rays cause a more or less intense redness on the skin. This blush

1) FINSEN: Hospitalstidende July 5, 1893, and: About the importance of chemical rays of light for medicine and biology. Leipzig 1899. p. 13.

is strongest at first and then decreases. Chemical rays, on the other hand, cause almost no redness, it only appears after a few hours and has its maximum 12 to 24 hours after exposure. In my experiment, as mentioned, the heat was very strong for the first 10 minutes, so the skin was immediately very red and just as red on the areas covered with ink as on the rest

Part; after 2 hours, however, the skin had already become much paler. So the heat rays were to blame for this blush. An hour later - 3 hours after the end of the experiment, the redness of the skin had increased again, but the areas covered with ink, glass and ointment were now less red than the surroundings, became less and less red and showed a completely white color the next day skin, while the redness of the surrounding skin always increased at the same time and reached its peak the following day, so the chemical rays were to blame for this redness.

The experiment with the letters shows how local and sharply limited the inflammation caused by the chemical rays is.

It is also interesting to see that the illumination of 20 minutes could produce such strong and permanent pigment formation that it was still visible after half a year.

Finally it is the attempt with the ointment. This was made to possibly be used by a patient whose skin was particularly sensitive to exposure to the light. The ointment consisted of ungventum glycerini colored with evaporated frangulade decoction. This was supposed to be protective because of its brown color, which it was. Incidentally, the ointment was not used, and the interest in trying it essentially coincides with the experiment with the ink drawings.

I did not achieve my intention with the differently colored pieces of glass by this experiment, since the skin under all of them, even under the clear glass, showed itself to be exactly the same and apparently completely unaffected. As mentioned above, this success showed extremely clearly that the redness that appeared on my skin was exclusively

Meanwhile, one cannot conclude from this that visible chemical rays cannot produce photochemical ignition, one can only say that the light used was either not strong enough or that the experiment did not last long enough. That the visible chemical rays, or rather that the light filtered even through glass lenses several inches thick, is capable of producing a photochemical inflammation of the skin, is a daily experience in the treatment of skin ailments with concentrated light, both with the use of electric light and as well as sunlight. Even if the light, in addition to the 4 thick glass lenses in the used collecting apparatus, is supposed to pass through a solution of methylene blue or an ammoniacal solution of sulphate of copper, which solutions absorb most of the ultraviolet rays, there is still a clear and often strong photochemical inflammation, of one pigment formation followed.

Incidentally, in order to examine this latter relationship, I have also made some experiments with sunlight on my arm. I concentrated the light through a rock crystal collector consisting of a conical metal container, one end closed with a rock crystal lens 10 cm in diameter and with a focal length of 22.5 cm , and the other end with a flat rock crystal plate of 7 cm was closed. The intermediate layer of water was 13 cm thick. With this apparatus the light was collected on the skin and different lights were produced by holding different colored pieces of glass in front of it. First I tried with rock crystal alone, then with clear glass, blue glass, green, orange and red glass, each color for five minutes 1).

At the same time, the illuminated spot was showered with a stream of cold water. — Considering the difficult, not to say impossible, task of making all the ratios (percentage luminous intensity, etc.) the same for all colors, I chose the rule of making the spot of light just big enough that I did not feel the heat.

In this way the spots of the different colors became of very different sizes (from 2 to 7 mm. in diameter).

The result of these experiments was that the skin reacted with the usual photochemical inflammation in the three places where the light had acted through the rock-crystal, the clear glass, and the blue glass, while not the slightest reaction appeared in respect of the other colors . The severity of the skin reaction followed in the same order,

userem

1) The light measurement, which was carried out during the experiment with Vogel's photo

meter was made, showed after exposure to one minute no. 12.

The absorbance ratios of the glass pieces are available from physical collaborators cand. mag. ABSALON LARSEN who kindly informed me of the following:

The bright glass allows approximately 90% of all visible rays to pass through. A narrow section of red was apparently weakened more, only passing 80%. Hence the blue-green tone in the transmitted light.

The red glass allowed 28% of the outermost red rays to pass, 23% of those in the middle and 4% of those of the yellow first. All other rays were completely absorbed.

The yellow-red glass allowed approximately 13% red, 5% yellow and 2% green to pass through.

The green glass passed a trace of yellow light, about 13-15% green light and very little blue light.

The blue lens let 33% through a narrow portion of the red, then almost none of the rest of the red; about 3% yellow, 7-8% green and also growing evenly to about 40% violet.

was strongest for the rock crystal and weakest for the blue glass. The size of the spot of light was as follows in relation to these three: for the rock-crystal 7 mm, for the clear glass 4 mm, for the blue glass 2 mm') in diameter. (As for the other colors, the spot was only 2–3 mm in diameter). I repeated the same experiment on another day with the same result.

In these experiments I made the observation that the red spots which appeared on the skin rose above the level of the same, they presented themselves as flat, hyperemic spots, the edges of which rose sharply above the normal skin. At the same time I have to add that

. no blistering occurred, so no detachment of epidermis was to blame for the elevation.

The experiments reported here not only confirm the results obtained by WIDMARK, they also extend them.

I will, however, return to the first attempt with the light from the 80 amp lamp on my arm. For this experiment became of great importance to me, as it made me aware of the remarkably powerful action of ultraviolet rays, and of the great importance which it would consequently have for concentrated-light phototherapy to use collectors with rock-crystal lenses instead of glass lenses. One has to assume that the ability of light to cause inflammation, in addition to its ability to kill bacteria, is of great importance for therapy. But since I saw the severe inflammation of the skin under the rock-crystal plate, an inflammation that seemed to be just as severe as that on the uncovered skin, it occurred to me whether the ultraviolet rays might not also have a correspondingly powerful effect on bacteria. 1) Hence I made some experiments with light through a rock-crystal collector on a culture of Prodigiosus seeded on a rock-crystal plate. This was followed by proof of an extraordinarily great bactericidal ability through these rays. A more detailed investigation of this ratio, together with the ability of the other radiation qualities to kill bacteria, was carried out by my assistant, Dr. Bie done, I take the liberty of pointing out the beautiful investigations contained in this book.

1) The method I chose here of making the spots so small

the fact that I couldn't notice the heat doesn't seem to look as good as when I e.g. B. would have made all spots the same size; but in fact the latter would have been much more imprecise, on account of the different ratios of absorption of the pieces of glass. It is quite interesting to note from the results that the reaction was strongest where conditions appeared to be most unfavorable (of course, if the same amount of light is concentrated on a large spot, the conditions are more unfavorable than where it is concentrated on a small spot is concentrated). In the experiment with the rock crystal, the light spot was 7 mm in diameter and here the reaction was strongest, for the green, orange and red glass the spot was 2-3 mm in diameter and here there was no reaction at all. Incidentally, I must point out that I only attach essential value to these experiments for the question of whether it is exclusively the ultraviolet rays which cause the photochemical reaction on the skin.

Another observation I made following this simple 20-minute exercise on my arm. I mentioned above that about 4 months after the experiment the skin was so pigmented that the white streaks formed by the glass strips could be faintly seen. A few months later they were no longer visible and the skin on the arm was the same color with no markings:

1) The views on this matter are as I already have in mine

Treatise On the Use of Concentrated Chemical Rays of Light in Medicine, p. 6, have hitherto been very different.

One morning, however, as I was toweling my skin as usual, I noticed that the markings on my arm reappeared, so that the parts of the skin which had been protected by the glass strips did not become as red as the areas around the toweling. This can only be explained by the fact that the expansion of the capillaries and vessels of the skin, which is a result of the action of the chemical rays on the skin, I have already examined this under the microscope on the tail of the tadpole),') to a certain extent so that it was still detectable 5-6 months after it was induced and even after the skin pigment had disappeared.

This dilatation of the capillaries of the skin, whether they be called pathological or normal, appears, though scarcely to such a degree as here, from any fairly strong exposure of the skin to light; and that it is of a certain beneficial importance to the skin is beyond doubt. It was reasonable to assume that more blood would flow to the skin, or at least that it would, if the capillaries were dilated, and further that the skin would be better nourished and consequently more functional. 2)

If it behaves like that, that's a common but not like that

1) FINS. Hospitalstidende d. November 1, 1893.

2) In this connection I shall refer to some older, very interesting ones

draw attention to investigations by BERTHOLD. He found that nails grow faster in summer than in winter. the same nail,

which took 116 days to be renewed in the summer

152 days in winter. Hair growth is also richer in summer

than in winter, and day than night. (Müller's archive for

Anatomy and Physiology 1850. p. 156). that this

the growth of the beard, and that the difference is quite significant

is, I have confirmed by asking various barbers

come. They declare it to be one well known to all barbers

thing that you don't get barbered that often in winter

needs than in summer

intense illumination has the same effect on the capillaries of the skin, we must expect, and find, greater blood-filling, or capacity to fill, in those parts of the skin which are daily exposed to the light than in those parts which are always covered by clothing so do we indeed.

The face, neck, and hands of most people are known to be of a far more intense color than the rest of the skin, and there is often a very sharp color boundary between covered and uncovered skin. That this is not characteristic of the face, neck, and hands alone, but of the skin in general, is clearly seen in children and in people who walk with bare arms and knees; the color of the skin always changes just to the part covered by clothing.

This strong color is of course largely due to skin pigment; it's usually easy to see that though

, is due in no small part to a more plentiful blood supply.

In the case of albinos, the blood is exclusively to blame for this reddening of the skin, and in the case of very blond people it is almost exclusively the blood. In autumn and towards winter, when the skin pigment begins to dwindle, it also becomes clear that the blood supply plays a major role in the color of the skin, even in the more pigmented people. Incidentally, even if the skin is very pigmented, you can usually see whether the pigment alone or also the blood filling is to blame for the skin color. When, in addition to the pigment, there is copious blood-filling of the skin, it presents itself as a warm, reddish-brown colour; on the other hand, when pigment is chiefly to blame, the color is greyish-brown and cold. This is often observed in the same person at different times.

This reddish color of the skin described here may well be regarded as such a constant phenomenon that it may be taken as a fact that the part of the skin which is not covered and which (at least in summer) is exposed to the light and the air exposed in a normal way will turn a redder color than the covered skin. With regard to the cheeks, special conditions apply, namely, these are very often red, although the rest of the facial skin, which has been completely exposed to the same external influence, is quite white. The red color of the cheeks must therefore be regarded as something special, as a breed peculiarity.

Meanwhile, it does not follow from this - although it seems to emerge from my investigations - that the light is to blame for this reddening of the skin. According to the prevailing view, one would rather say, at least with regard to the particularly strong forms, e.g. B. the complexion of the sailors and land people, coachmen and in general of the people who move a lot in the open air, that the wind and the weather are to blame. Analyzing wind and weather is not so easy, however, because even if light is included, ie in the form of heat (identical to the expression "sunburned") one thinks largely of air and water, especially in the form of storms and rain or snow identical to the expression "weather brown").

It may well be supposed that the rain and the wind act chiefly by the cold or by the heat which they possess, but in a far lesser degree they act mechanically by the force which, as it were, whips the skin. So while we can safely disregard the mechanical moment without harm; the relationship is quite different when it is cold and when it is warm.

The powerful influence of cold and heat on the dilatation and contraction of the vessels and capillaries, intense illumination having the same effect on the capillaries of the skin, we must expect a greater blood-filling, or capacity for blood-filling, in those parts of the skin which are daily exposed to the light , than in the parts always covered by the clothes, and indeed we find this.

The face, neck, and hands of most people are known to be of a far more intense color than the rest of the skin, and there is often a very sharp color boundary between covered and uncovered skin. That this is not characteristic of the face, neck, and hands alone, but of the skin in general, is clearly seen in children and in people who walk with bare arms and knees; the color of the skin always changes just to the part covered by clothing.

This strong color is of course largely due to skin pigment; but as a rule it is easy to see that a not inconsiderable part is due to a more plentiful supply of blood.

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The powerful influence of cold and heat on the expansion and contraction of the vessels and capillaries

are phenomena that have been known for a long time and cannot be overturned. Its importance for this question will therefore generally not be underestimated, while it will be more difficult for light, hitherto neglected, to have its part in this phenomenon recognized. It is the same here as with two other phenomena caused by light: the formation of pigment in the skin and the solar erythema; it was believed that "wind and weather" were to blame for pigment formation and that solar erythema was due to solar heat; but now we know that the chemical rays of light are to blame for both phenomena.

According to my observations, chemical rays have the ability not only to produce the well-known acute reddening of the skin, but also to permanently dilate the capillaries of the skin. On the other hand, there is scarcely a more well-known phenomenon than the intense redness which appears on the skin after exposure to both intense heat and intense cold. Precisely for this reason, however, the analysis becomes a very large part of the reddening of the skin') this or that of these three agents

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1) By mentioning the physiological flushing of the skin, one must not do that

mention interesting "blushes" due to psychological reasons. In Darwins, The expression of the emotions, 1872, where blushing is made the subject of an investigation, there are several matters of interest to us. So Darwin says (p. 315): 'It is an interesting question why only the face, ears and neck become mostly red, although the sensation and feeling of warmth often extends to the surface of the whole body. This appears to be chiefly due to the fact that the face and adjacent parts of the skin have been habitually exposed to air, light, and changes in temperature, whereby the small arteries not only have become accustomed to being easily dilated and contracted, but they also appear in the to be unusually well developed compared to other parts of the surface. Incidentally, this view is confirmed by the fact that certain breeds that go almost naked often blush on the arms, chest and abdomen.

be difficult, since an isolated effect of the same cannot easily be carried out.

If I do attempt such an analysis in what follows, it is not because I underestimate the difficulties involved - one must especially remember that agents other than the three mentioned here would also like to have an influence - but because I this can lead to other contributions to the solution of the question. Let us first consider the reddening of the skin caused by heat, of which we can probably point out two types, one direct and one indirect. One—the direct—is "heat erythema," which

, caused by the local effect of strong heat, it is based on a paralysis of the muscles of the skin vessels and, in contrast to the light erythema, appears immediately after the effect and also, in contrast to the light erythema, disappears very quickly in relation to the intensity of the effect, sometimes after a few minutes, sometimes after a few hours.

A heat strong enough to produce such an erythema does not exist in the medium surrounding us, at least not in our climate, so that we can completely ignore it when we speak of the natural redness of the skin.

The other kind of reddening of the skin which can arise from the action of heat - the indirect one - is of greater importance to us; it appears when the heat of the body becomes too great, either from the warmth of the surrounding air or from increased heat production in the body itself, and the blood rushes to the skin. Now one might think that if this process were repeated very often, a permanent redness of the skin would appear. However, this is not the case, the opposite seems to be taking place, a fact which we can see in people who are particularly exposed to greater heat, e.g. B. the bakers, stokers, metal founders whose pale complexion is just characteristic. Europeans who settle in the tropics are also said to commonly acquire a pale or sallow complexion, although the skin becomes more pigmented.

So we see that heat mostly seems to play a negative role in relation to the etiology of erythema.

The relationship with the cold seems to be different. The first manifestation, when the skin is exposed to cold, is, as is well known, a contraction of the muscles and vessels of the skin, so that the skin turns white; but later, especially after a long and severe exposure to cold, there appears a reactive intense reddening of the skin, the duration of which corresponds to some extent to that of the heat erythema (all of which can usually be reckoned in minutes or hours, in contrast to the light erythema, the duration of which must be reckoned in days. During so the reactive erythema itself in each individual case rapidly disappears, it might happen that frequent repetition of this pro in contrast to the effect of heat causes a permanent red color of the skin, I call e.g. B. the complexion of coachmen and sailors in winter. But the same parts of the skin which are affected by the cold are also exposed to the light, and it is difficult to determine how much is due to one factor and how much to the other.

We know that strong light, even without the help of cold, produces a fairly permanent redness (erythema of light).

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1) C. LANGE: Almindelig patologisk Anatomi. 1896. p. 60.

can; However, I have often had the opportunity to see after sunbathing and electric (photochemical) light baths, which we have in the light institute, that frequent exposure to light that is not so strong can also cause a reddish color of the skin in addition to the pigmentation, without erythema ever being present use. On the other hand, it is more difficult to determine how far the cold can cause a permanent, normal reddening of the skin without the mediation of light. As it must be regarded as immaterial whether the cold acts in the form of cold air or cold water, one might perhaps expect to gain some insight by considering the effect of frequent cold baths, e.g. B. cold rapid baths or particularly cold foot baths observed (because here one needs a longer lasting effect of the cold). As is well known, however, the skin does not acquire any permanent red color worth mentioning, at least not a color which can be compared with that which the uncovered skin has. However, in these baths the ratio is such that the skin is covered by clothes in the time between cold exposures, which could possibly make a difference, and for this reason they can only be paralleled with the light baths, their effects on the skin I just mentioned.

On the other hand, one can possibly learn something about the uncovered parts of the skin by examining how the North Pole travelers fare, who are exposed to very severe cold and at the same time have to live for several months of winter in the darkness of the polar night. It is so fortunate that some investigations into the color of the skin after wintering are available from a polar expedition; namely: "Undersökningar till förklaring af hudfärgens anmärkta förändring efter öfvervintring i polartrakterna, utförda under den senaste svenska Spetsbergsexpeditionen af dess läkare R. GYLLENKREUTZ och meddelade of FRITHJOF HOLMGREN." made by her doctor R. GYLLENKREUTZ during the last Swedish expedition to Spitsbergen and communicated by FRITHJOF HOLMGREN). (Upsala läkareförenings förhandlingar 1883–84, p. 190).

HOLMGREN writes: "Those who took part in the early winterings in the polar regions often perceived a change in skin color as a peculiar phenomenon which manifests itself as daylight reappears after the long winter night, and which gradually disappears.

It should suffice here to cite a few statements about the observed effects of the winter night when daylight is approaching.') KJELLMAN describes the relationship in the following way, translated from Swedish: "How bright we found it outside already in the first days of February, and How strange it seemed to be able to clearly distinguish the surrounding objects again in the open air, to see oneself and the comrades standing nearby or walking. We also looked at each other with great attention. Of course, we had all suffered changes in the course of time. With our yellow-pale, sagging, emaciated, beard-covered faces we did not remind of the same people from the summer. The influence of the darkness stood out clearly!" In the report of the doctor, which KJELLMAN 2) quotes, says

1) FR KJELLMAN: Svenska Polar-Expeditionen år 1872-73 under ledning

af AE Nordenskjöld, p. 226.

2) Cited in the same book: pp. 232, 233.

It says about the same thing: "The winter climate in Svalbard, which in terms of severity cannot be compared by far with that of North America's Archipelago or Siberia, was allowed, on the other hand, both because of the long-lasting, low temperature, the frequent storms and snow flurries, the strangely fast before changing weather conditions, above all the unbearable darkness, are regarded as less healthy. The action of these showed itself somewhat differently in different individuals. In some there developed drowsiness, indifference, and lassitude, in others a marked irritability of mind, with generally great depression, some complained of insomnia at night and of great tiredness during the day, and in all without exception a more or less pronounced chloroanaemic condition developed . On the return of the sun, the dominant complexion was pale, verging on yellow-green, as in plants grown in a dark room with insufficient light. Another effect of the long arctic winter, which may be attributed indirectly to the darkness, and which depends more directly on the anemic condition, was a general dyspepsia, a sort of atony of the digestive activity," etc

As can be seen from this, the changed skin colour, which KJELLMAN describes as "pale yellow" and the doctor as "pale verging on yellow-green", appears to be a constant consequence of hibernation, and which, from the statements just quoted, of all the contributing factors mainly attributed to the influence of darkness."

Next HOLMGREN tells how in Upsala, during a discussion about this changed skin color, the statement was made as to whether it might not be a subjective phenomenon and on a change in the color sense in the Be

observer, caused by the fact that the eye has had to do without daylight for so long. Therefore, in the forthcoming expedition to Svalbard, it was determined to investigate to what extent the change in skin color was an objective or subjective phenomenon. The examinations were carried out by the doctor GYLLENKREUTZ in such a way that one of the participants of the expedition was to remain in the dark in the spring when the sun returned until the skin of the other participants had assumed its natural color again. The engineer ANDRÉE offered himself to this embarrassing attempt. GYLLENKREUTZ writes about this in a report (written in March 1883 on Spitsbergen): “January 24, 1883 was the first day on which greater twilight appeared. Mr. ANDRÉE AÉE) had willingly offered to remain in the dark and artificial light until the rest of us had acquired a normal color from daylight. He began his ordeal the same day.

On February 21st the light corresponded to a normal winter day in Sweden. We watched the sun from a 1500 foot high mountain range. At noon a general examination was made and the complexion of each participant was determined by all the others and the person concerned was able to check the judgment in a mirror.

The verdict was unanimous that all had a white, already delicate, slightly rosy color, tinged with rosy as they say. A lone (EM) had a very insignificant shade of yellow-grey color on the nostrils. That's what AÉE came up with and had to first decide on the color of each one, and his judgment was exactly the same as ours. Then he was compared with the rest in turn, and we all found, including himself through the looking-glass, that his color was quite a bit different yellow-gray, although he had pretty roses on his cheeks."

I have reported these investigations at some length because they are very peculiar and of great interest to the question under discussion. It turns out that everyone, even ANDRÉE, had "roses on their cheeks", and while ANDRÉE's complexion was somewhat yellow-grey, all the others had "a white, albeit delicate, color that changes somewhat in the red." On another Where the details are mentioned in the assessment, the expressions occur, he was 'pale as a city girl', white and red, 'quite like a delicate city lady.' Except for the cheeks, for which, as mentioned earlier, are very special conditions, one is undeniably amazed that these people, who had been exposed to the excessive cold and the unfriendly weather of the polar regions for a whole winter, all had a "white, almost delicate color". Of course, we must not forget that these people may have had some anemia, but according to GYLLENKREUTZ, it was only to a minor degree.

Be that as it may, these investigations do not indicate that the cold alone is of great importance for the appearance of erythema. On the other hand, since we see every day that people who are exposed to both cold and light develop a very strong red skin color, namely much more intensely than those who are exposed to the sun and heat, it does not seem unjustified to assume that the cold promotes or supports the appearance of the red color of the skin.

Finally, I will briefly recap and specify what has been achieved through these investigations.

1) The accuracy of WIDMARKS investigations about

the influence of light on the skin is confirmed and, moreover, expanded in relation to the fact that visible chemical rays also have the ability to produce a peculiar photochemical inflammation

shout. 2) It is proved that in the electric light the

the strongest bactericidal power belongs to the ultraviolet rays, and as a practical result of this phenomenon there has arisen the necessity of using exclusively quartz lenses in electric light-gathering apparatus; and this change has made very great advances in treatment with concentrated

result in light. 3) I have proved that by the chemical

(The ultraviolet) rays induced expansion of the capillaries of the skin is of long duration and one has it about half a year after exposure to light

can be detected macroscopically. 4) A compilation of the various on the skin

The factors at work have shown that the normal reddish color which every skin gradually acquires when it is not covered owes its origin, if not exclusively, at least to the light, ie to the chemical rays of light, to a great extent. The development of the reddish color of the skin appears to be inhibited by exposure to heat and promoted by exposure to cold.

For the study of the physiological effects of light, the proof of points 3 and 4 is a good step forward. For while up to now, when talking about the effect of light on the skin, only acute reddening of the skin has been recognized and pigmentation has been regarded as the most essential or only chronic effect or consequence of the action of light, now chronic reddening of the skin has also been added a phenomenon also due to exposure to light.

The reason that this chronic effect of light has been overlooked is undoubtedly that the skin pigment that occurs at the same time has most often been noticed and has occupied all attention, as well as that the pigment is partly responsible for the red color of the skin skin has covered. On the other hand, in cases where very little pigment has formed and hence a distinct reddening of the skin, or where the pigment has disappeared and the reddening of the skin has become more prominent, factors other than the chemical rays of light have usually been ascribed this effect!

We have thus taken a step forward, but the step is not complete, in that we do not sufficiently understand the importance of a plentiful supply of blood to the skin—we may conclude that the skin is thereby better nourished and better able to perform its functions, what for functions they are, but we don't know exactly yet. Only when we know this will the meaning of the effect of the light become clear to us, and we will then certainly have to acknowledge at the same time that in the chemical rays of the light we have a means that is perhaps the most powerful that we have -- for the skin functions through

Application of light baths to help. Finsens Medical Light Institute,

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We have some time at the Light Institute - but essentially for a different reason

made some attempts with a therapeutic use of such photochemical light baths 1) (sun baths, electric light baths). Meanwhile, our material has hitherto been somewhat scant, and we have not yet passed the experimental stage.

1) With these I don't mean the recent ones, of course

so very much used incandescent light baths or weak arc light baths, but very strong arc light baths (lamps at 100 amps). By the way, see my remarks about light baths: About the importance of the chemical rays of light for medicine and biology. Publisher of FCW Vogel. Leipzig. 1899. Pages 69-71.

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If electricity is available in the laboratory,

As I shall discuss further below, there are certain advantages to heating the thermostat by means of an electric bulb. To make this possible I constructed the following electrical thermoregulator.

Basically it consists of a spring formed by two strips of metals with different coefficients of thermal expansion (e.g. steel and brass or steel and zinc) soldered together. One end of the springs is fixed, the other carrying a small platinum plate on the brass side leaning on a platinum-tipped screw. The current of the bulb passes through the spring and this platinum contact; as soon as the temperature has reached a certain level, depending on the position of the screw, the contact is broken due to the greater expansion of the brass and the bulb goes out; later, as soon as the temperature begins to drop, contact is established again, etc

This simple device, which any mechanic can easily make, works very satisfactorily. Any boost

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lade or wooden box can be used as an improvised Ther

must work. For years and days there is one

Thermostat in the Light Institute R

in uninterrupted activity

ability. The production costs S

for the regulator (along with the incandescent lamp) was approx. 8 Mk., the thermostat

box (very simple wooden B A

cupboard, 30x30x65 cm) about as much. The accuracy of regulation is approx. 2° C. as the greatest

Deviation; for days the temperature hardly fluctuates around 650

It's a nuisance here

after all, that the incandescent lamp, as is well known, only works for a certain period of time;

if you can be absolutely sure S +

wants the lamp out after a few months, maybe just in an uner

wished moments r

fails in its service, it must be renewed more often than

otherwise necessary. D

Partly for this reason, partly for even greater accuracy and security

to achieve regulation, I later had the regulators, who now do too

it

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in use in various other laboratories can be set up in the following way.

On a slab of slab SS, two springs (A and B) are fixed.

Spring A has its brass strip on the right, spring B has itss on the left. A has one platinum contact near the tip for screw c, B has two for screws d and e. These three screws all have platinum tips. The current enters at +, passes through contact c, spring A, spacer m, spring B and divides at d and e into two branches for one each of the two bulbs D and E, whereupon it exits through the thermostat.

To set this regulator for a certain temperature, say 37°, you first screw d and e quite far to the right, so that even if the temperature is too high, these contacts are not broken. C is now set so that the lamps (both at the same time) at z. B. 37.5 ° go out. Now that this temperature has been kept constant for a few hours, the screws d and e are turned back so much that the temperature is now kept at 37°. These screws can easily be adjusted in such a way that when you open the thermostat door, lamp E lights up first, and 2 seconds later D lights up. The two contacts d and e are now actually responsible for the regulation alone, in that the screw c set for 37.5" always remains in contact. This latter serves as a safety device; namely, should (which by the way never happened to me) d or e , e.g. because of dirt, does not interrupt the current at the right time, c already becomes active at 37.5. c also has another use. Namely, if one wishes to work temporarily at a lower temperature than 37", one sets very easily to the desired temperature a medium c without worrying about d and e. As soon as you close again

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37°, simply turn e back towards you, a little too much rather than too little; d and e then immediately take over their old role without having to worry about setting to 37 again.

If, as discussed above, e makes contact a moment earlier than d, with the thermostat door closed, only e (with lamp E) will function, E igniting and going out several times a minute. But as soon as the door is or was open, both lamps burn simultaneously because of the stronger cooling, and the desired temperature is thus reached again as quickly as possible. Finally, d will also come into action if the other lamp has burned out, which is noticed at once when the door is opened, since only one lamp then ignites. Bulb E will of course, all things being equal, always burn out first.

For the thermostat room I use a double-walled wooden box with a double door. The light bulbs are placed in a double-walled or at least tinfoil-lined wooden chimney (R,R) of the shape shown in the figure, partly to get the same temperature everywhere, partly to keep the light keep away from the cultures. I use light bulbs with 25 candles each at a voltage of 110 volts; more powerful lamps tend to cause excessive sparking at the contacts. Two such lamps are sufficient for a space of more than 100,000 cm.3 The advantages of this apparatus are: 1. Exact and reliable regulation. An accuracy of 1oO is easily achievable.

10. 2. The simplicity with which you can quickly switch to other Tempe

can set temperatures. 3. The rapidity with which rewarming after opening

the door takes place. 4. The safety compared to a day and night

burning open gas flame, especially in laboratories where there is the possibility of gas explosion caused thereby

sion can hardly be completely ruled out. 5. The price is in comparison with those in stores

Thermoregulators of appropriate accuracy and

Safeness a very low (about 1/3). 1)

On the other hand, as far as the running costs are concerned, the ratios vary somewhat, partly according to the local price of electricity, partly and mainly according to whether the thermostat is installed in a heated room. In the latter case, the maximum that can be expected is that an incandescent lamp lasts around 10 hours per year. burns 24 hours. If you only need the thermostat from time to time, the running costs can be even lower than for gas, because you only have to turn on the electricity a short time before use, while an ordinary thermostat has to be constantly on to be always operational.

I; Mr. Electrician Thomsen, Sortedamsdosseringen 77 1, Copenhagen N., IV.

delivers the regulator at a price of 20 marks; a complete thermostat with a volume of approx. 70,000 cm 3 at a price of 100 marks.

Studies on the bactericidal effect of the various departments

of the spectrum

from

Valdemar Bie.

the

ie investigation of the bactericidal effect of the various

in which spectral regions is not only of great theoretical and practical hygienic interest, but also of the greatest importance for the therapeutic application of the bactericidal ability of light. It shows which rays are to be excluded as useless or harmful, and which are to be exposed to the light in as large a number as possible for the treatment of the sick. - By using different light sources and light filters, one can control the composition of the phototherapeutic agent to the same degree as the composition of any other therapeutic agent.

The earlier investigators of these conditions did not obtain a sure result, not because they had not mastered the physical part of the experiments, and partly because they used comparatively weak light. i will im

describe the type of tests and the results below for comparison with the technology developed here at the institute.

literature review.

DOWNES and BLUNT (1877) and 1878 dealt with the present question in the two papers in which they first demonstrated the bactericidal effect of light. They grew the bacteria in small test tubes with PASTEURS liquid; as a rule, they inoculated with a liquid containing numerous species of bacteria (not pure cultures); sometimes self-infection was used.

A portion of the test-tubes were exposed to sunlight, either in boxes of colored or in those of clear glass; others were exposed directly to sunlight, and still others were sealed in lead plates, lightproof.

Whether microorganisms were developing could be seen from the turbidity of the liquid, and microscopy confirmed that they were bacteria.

In the first series of experiments, no spectroscopic examination of the colored glasses was carried out; in the other, this investigation gave the following result: the blue glasses allowed the violet and blue rays, and some green and yellow-green ones, to pass, while the yellow glasses allowed the whole spectrum to pass, except the violet rays and about half the blue rays. The red lenses let through the red and orange rays.

The test-tubes in which bacteria first developed were those wrapped in lead; then they followed

DOWNES and BLUNT: Researches on the Effect of Light upon Bacteria and other Organisms. Proceedings of the Royal Society of London. 6 Dec 1877. Vol. 26.

those in the red box, and shortly after that those in the yellow; no bacteria developed in the test tubes of the blue and light glass boxes. DOWNES and BLUNT stated the result of the two series of experiments in the following propositions. "So far as our investigation has extended, the action appears to be chiefly, perhaps not exclusively, bound up with the chemical rays of the spectrum." - "That the action chiefly depends upon the blue and violet rays is shown by the great difference between the test-tubes in the blue and in the yellow box, the latter letting through all the rays except violet and part of the blue.

Further, experiment seems to show us that the red and orange rays are not entirely ineffective, for turbidity occurs later in the red-box test-tubes than in the lead-cased ones, as soon as the nourishing liquid is sufficiently concentrated.

If the phenomena were represented in a curve, it would peak at or near the violet, descending rapidly in blue or green, but then extend about as far as the red is visible."

E. SERRANO FATIGATI (1879) only reports about his technique that he produced colored light using solutions of fuchsine, nickel nitrate (green), Lyon blue and Parma violet. He came to the conclusion that violet light favors the development of the lower organisms, while green retards it.

Downes and BLUNT: On the Influence of Light upon Protoplasm. Proceedings of the Royal Society of London. 19 Dec 1878. Vol. 28.

E. SERRANO FATIGATI: Influence of the various colors on the development

and the respiration of infusions. Comptes rendus hebdomadaires des séances de l'Académie des sciences tome 89, 1879, p. 959

ment

ARLOING (1885) made some experiments with Bacillus anthracis grown in flasks of unstained chicken broth; these were placed in a glass-doored thermostat, and were illuminated by a strong gas-lamp, the light of which was collected on the bulb by a glass lens; the colored light was produced by passing the light through light filters (glass dishes with parallel flat walls) containing colored liquids. Control flasks were kept in a dark thermostat at the same temperature.

The author summarizes the results of the experiments in the following way:

“The presence or absence of artificial white or colored light does not affect the growth of Bacillus anthracis too much; but spore formation is fastest in the dark and in the less refractory rays of the spectrum.” By this the author means those to the left of Fraunhofer's line F, i.e. the red, orange, yellow and green.

Arloing later made some experiments on the influence of sunlight on the growth of anthrax spores. He again used flasks of broth inoculated with anthrax spores. Sunlight was directed against the flasks by a heliostat. The colored light was brought out as before by light filters with colored liquids. Flasks were placed on ice overnight if necessary.

If you put a light filter in front of the bulbs,

MS ARLOING: Influence of the lumière on the vegetation and les proprietary pathogènes du Bacillus anthracis. Comptes rendus de l'Académie des sciences. 9. February 1885, tome 100, p. 378

ARLOING: Influence of Soleil on the vegetation of the spores of Bacillus anthracis. Comptes rendus de l'Académie des sciences 24 August 1885, tome IOI, p. 511

which allowed only the red or chemical rays to pass through, the illuminated bulbs became clouded almost as much and rapidly as those standing in the dark.

A simultaneous investigation of the effect of all the colors was obtained by hanging a Pasteur's pipette, prepared in the usual way, for 4 hours in all seven sections of the solar spectrum. The next day, bacteria had developed in all pipettes, while the control pipette, exposed to undivided sunlight at the same time, was sterile.

The author therefore says:

“Consequently, the inhibitory or destructive effect on the viability of Bacillus anthracis does not appear to depend on individual rays of the spectrum; rather it belongs to the undivided sunlight.”

LÜBBERT (1886) worked with Stafyloc gelatine cultures. pyog. aur. in test tubes. He divided these into four groups; the first group was placed in a blackened box, the second in a container with double glass walls, between which was a solution of chromate of potash (allows only non-chemical rays to pass through it); the third group was placed in a similar container with copper oxyammonium (lets only the chemical rays through) and the fourth placed in an empty test tube. All four groups were placed in sunlight near the laboratory window for the same amount of time. After 10 days of illumination, no difference could be seen in the appearance of the cultures. After four months of illumination, inoculation from the test tubes was made with no difference in energy

from

LUBBERT: The Staphylococcus. pyog. aur. and the osteomyelitis coccus. Würzburg 1886, p. 14. Ref. in SPACE: Biological significance of light. Journal of Hygiene. 6th vol., 1889, p. 327.

grow stock. The author has therefore obtained a completely negative result, both with regard to the effect of undivided sunlight and that of colored light.

JANOWSKI (1890) carried out experiments with the typhoid bacillus, which was inoculated in test tubes as a line culture on slanted gelatine or agar. The test tubes were lowered into flasks of colored liquids containing solutions of fuchsine, Bismarck brown, methylene blue and gentian violet.

The spectrum of Bismarck brown consisted of the red, orange, and yellow rays and half of the green. The spectra of the other solutions contained all parts of the solar spectrum, only in different amounts.1) In addition, two test-tubes were placed in flasks with distilled water, one of which was sealed in a light-tight container.

The flasks were placed 30 cm from the window in a cold room with the inoculated area of the gelatin against the light. The author found, in experiments with diffuse daylight, that the development of the bacteria was far more rapid and vigorous in the dark and yellow flask than in the others; within these two groups the difference was smaller; growth proceeded better in the dark flask than in the yellow, and better in the red and blue than in the violet.

JANOWSKI then made experiments with direct sunlight. For this he used test tubes with broth

8th vol.,

JANOWSKI: Centralblatt for bacteriology and parasitology. 1890, p. 167.

I) The spectrum of a non-monochromatic solution is always off

composed of two or more colors, e.g. B. the spectrum of methylene blue consists of a blue and violet section, which contains a large part of the blue and violet rays emitted by the light source, as well as a faint green and yellow part and a very faint red part.

cultures of typhoid bacillus, otherwise the same procedure as in the previous experiments. In addition to the four colored liquids previously mentioned, a solution of bichromate of potash was used, the spectrum of which included the red, orange, and yellow rays, as well as the beginning of the green.

The test tube in the dark and the one in the double chromate of potash became cloudy after 8 hours; the broth in the other test tubes remained clear as long as the experiment lasted (5 days). The bacteria therefore developed just as well behind dichromated potash as in the dark; consequently the rays are harmful which are absorbed by bichromate of potash, namely the chemically acting rays. In another experiment, a test-tube of typhoid broth culture was placed in a flask of gentian violet, at the same time one test-tube was placed in a flask of Bismarck brown, another in a flask of fuchsin; after 2 days there was severe turbidity in the test tubes with Bismarck brown and with the double chromate of potash; those which had been in fuchsine and gentian violet were sterilized at the same time.

SANTORI (1890) presented almost monochromatic light through two stained glass plates mounted 5 cm apart in a wooden frame; a test tube gelatin culture was suspended between the glass plates and exposed to sunlight. The experiment was carried out simultaneously with red, violet, and uncolored glass. Cultures of the typhoid bacillus, Stafyloc. pyog. aur. and the Spirillum cholerae asiaticae.

SANTORI: Bulletino della Academia medica di Roma vol. 16, 1889-90, p. 386.

It was found that undivided sunlight has a powerful microbicidal action, but that "the violet and red rays of sunlight do not kill the microorganisms, nor produce any visible change in their development."

RASPE (1891) found that the blue and yellow rays limit the viability of the anthrax spores, while the green, violet and red rays have no discernible effect.

Geisler (1892) placed some test tubes with gelatine cultures of typhoid bacillus in the infrared, red, yellow-green, violet and ultraviolet parts of the spectrum of the sun and of electric light. The same was represented by two prisms of flint glass, the type of glass which allows most ultraviolet rays to pass through.

Geisler drew the following conclusion: “All rays of the electric and solar spectrum, except the red ones, inhibit the growth of typhoid bacilli; this inhibiting effect is all the stronger, the greater the refractive index or the smaller the wavelength of the corresponding rays."

KOTLJAR (1892) investigated the effect of light on Bacillus pseudoanthracis, Sarcina aurantiaca, Micrococcus prodigiosus and on a raspberry coccus grown on agar and potatoes.

Colored rays were produced by passing the light through a layer of colored gelatin smeared on the outer surface of the test tubes.

Only the red and violet light were examined. The result was that growth was most inhibited by the uncolored direct sunlight, less by the violet rays, and least by the red.

RASPE: Influence of sunlight on microbes (Diss.). Schwerin 1891. Ref. in Baumgarten's annual report, 8th year 1892, p. 505.

GEISLER: Central Journal for Bacteriology. 6th year, 11th vol., 1892, p. 161.

E. KOTLJAR: Wratsch 1892, nos. 39 and 40, ref. in the Centralblatt für Bacteriologie, 12 vols., 1892, p. 836.

CHMELEWSKY (1892) examined the pus bacteria by the same method as Geisler. He found that the inhibiting effect of light is not only linked to the actual rays of light, but also to chemical rays and heat rays; the least effective are the red and infrared rays.

BUCHNER (1893) made agar plate cultures of typhus bacilli in dishes on the bottom of which was stuck a cross or something similar made of lightproof paper; the underlying part of the culture served as a control. The dishes were placed with the bottom facing the light source in the different parts of a spectrum presented by an electric arc lamp with a parabolic reflector and a quartz prism. Quartz, unlike glass, allows the extreme ultraviolet rays to pass through; nevertheless the author uses glass bowls. The author says about these experiments:

"However, the observations made are too few in number to be able to draw firm conclusions from them. For the time being, it was only found that in typhoid bacilli, the development in the range of orange, red, ultra-red and also the ultraviolet remained completely uninhibited, contrary to expectations, while the brightest part of the spectrum: green, blue and partly violet, had a growth-inhibiting and killing effect on the seeded bacteria uttered."

P. CHMELEWSKY: Wratsch 1892, no. 20, ref. in the Centralblatt für Bacteriologie, 12th vol., 1892, p. 174.

BUCHNER: Archive for Hygiene, 17th vol., 1893, p. 179.

LEDOUD-LEBARD (1893) investigated the conditions of the diphtheria bacillus in the following way: he placed smaller test tubes with a diameter of 5 mm with a suspension of diphtheria bacilli on the axis of test tubes with a diameter of 3 cm. The large test-tubes were then filled either with water or with a saturated solution of dichromated potash, or with an ammoniacal solution of copper sulphate. He found that the bactericidal ability is almost exclusively tied to the most refracted rays of the solar spectrum. These are just as effective as the collected white light. The least refractory rays have no bactericidal effect, or at most so weak that the slurry affected by these rays behaves in the same way as those preserved in the dark."

MARSHALL WARD (1893 and 1894) exposed an agar plate covered with a zinc plate containing anthrax spores to sunlight; a letter had been carved into the zinc plate. So he used the “Buchner method” in reverse. The sun's rays passed partly through colored glass, partly through light filters with colored liquids.

No bactericidal action was discovered behind the glasses, which allowed only red, orange, and yellow rays to pass through, but the blue and violet rays were cut off; the effect was doubtful behind a green glass, which absorbed most of the red, orange, and blue-violet rays, but transmitted the yellow, green, and some of the least refractory blue ones;

LEDOUD-LEBARD: Action de la lumière sur le bacille diphtérique. Archives de Médecine expérimentale et d'Anatomie pathologique. Series I, tome 5, 1893, p. 779.

H. MARSHALL WARD: Proceedings of the Royal Society of London vol. 52, 1893, p. 393 and vol. 53, 1893, p. 23. Finsens Medical Light Institute.

on the other hand, a distinct effect was discovered behind all the glasses which let through most or all of the blue and violet rays, whether or not they cut off the red, orange, and yellow rays. So the result was that the bactericidal effect of the sun's rays is due to the rays of the blue-violet half of the spectrum."

This result was essentially confirmed by the use of the light filters with an ammoniacal solution of copper oxide, which cut off all the rays from the red to the line b (in the green), and with a solution of dichromated potash, which cut off all the rays from b to the right. This experiment showed that the rays which pass through dichromated potash inhibit growth a little, but much less than the others.

WARD obtained approximately the same result in the investigations carried out later, with essentially the same arrangement as that described here, as well as in the following beautiful experiment:

The spectrum of sunlight or electric arc light was projected onto an agar plate into which the spores and bacteria to be examined had recently been inoculated. The Bacillus anthracis, Bacillus subtilis, a

. purple bacillus from the Thames and several other Thames bacilli were studied. The spectrum of the electric light was represented by a quartz prism. The agar plate culture was kept on ice throughout the experiment.

Neither in the sunlight nor in the electric light had the infrared, red, orange, yellow or green

H. MARSHALL WARD: Proceedings of the Royal Society of London vol. 54, 1894, p. 472.

H, MARSHALL WARD: Proceedings of the Royal Society of London vol. 56, 1894, p. 315

radiate an effect; this only started at the blue end of the green, reached its maximum at the transition between the blue and violet, and was again restricted in the violet and ultraviolet regions. In the electric light, which is very rich in ultraviolet rays, the action extended well into the ultraviolet as soon as the light passed through quartz alone; but if a piece of glass was inserted, a large part of these effective rays were cut off.

DIEUDONNÉ (1894) prepared agar plates from Microc. prodigiosus and Bacillus fluoresc. putridus in Petri dishes; on the bottom of it was stuck a cross of paper according to Buchner's method. To represent the various sections of the spectrum he used: I. an aqueous

1. Solution of potassium bicromate, which let through the red, yellow, and part of the green rays; 2. A concentrated aqueous solution of copper chloride, with the addition of a few drops of hydrochloric acid; it allowed only the green and green-blue rays to pass; 3. Ammoniacal copper sulphate solution which absorbed red, yellow and green; 4. 1% quinine sulphate solution with a few drops of sulfuric acid; she absorbed ultraviolet. These solutions were poured into flat bottles placed on the bottom of the dishes. The thickness of the absorption layer and the duration of the illumination were always the same. Sunlight and electric arc light were used as the light source,

Growth and pigment formation behind the solution of dichromated potash were as profuse as in the control plate in the dark; behind the cupric chloride solution a slight inhibition of development was observed, the pigment formation being weak and slow; behind the copper sulphate solution all germs were killed, behind the quinine sulphate solution there was very minimal growth.

DIEUDONNÉ: Works from 1894, p. 405.

the Imperial Health Office 9. B.,

In another experiment, DIEUDONNÉ placed the shells in the various sections of a spectrum about 2 m wide, represented by an electric arc lamp on goo standard candles and by a Rutherfords prism. In this series of experiments, in addition to Bacillus fluorescens and Microc. prodig. also the bac. coli examined. The growth in the ultra-red, red, orange and yellow parts was very abundant; the pigment formation and trimethylamine development of the first two bacteria repeatedly appeared to be even greater than on the control plate in the dark. A weakness in growth could also not be demonstrated between D and E, that is, in the yellow part of the spectrum; on the other hand, there was marked inhibition of development in the green between E and F, and in the blue, violet, and ultraviolet parts of the spectrum the plates were completely sterilized.

D'ARSONVAL and CHARRIN (1894) illuminated a pyocyaneus culture with bright electric arc-light, another with the same light, after it had been passed through a solution of dichromated potash, which deprived it of its chemical rays; then a drop from the cultures was inoculated into agar, which was placed in thermostat. By sufficiently long illumination, the former culture was sterilized while the latter was unaffected.

BILLINGS and PEEKHAM (1895), who worked with typhoid and colibacillus, found no special effect of the

D'ARSONVAL et CHARRIN: Archives de physiology normal et pathologique 5. série, tome 6, 1894, p. 335

BILLINGS and PEEKHAM: Science, Feb. 1895. p. 169, ref, in the Centralblatt für Bacteriologie. 19th vol., 1896, p. 244

Sunlight passed through red, orange, yellow, or green panes of glass (not spectroscopically examined); on the other hand, the blue and violet rays killed the bacteria almost as quickly as the undivided sunlight.

KRUSE (1895) dried anthrax spores on coverslips, placed them in dishes and illuminated them with sunlight. From time to time a coverslip was taken from each dish, the dried spore layer was softened with a little broth and then processed for plate culture. The attempt was made May 3, 1892 in Naples.

The remaining ratios are learned from the following scheme, in which the numbers indicate the number of spores capable of growth.

#4

#3

#5

The duration No. 1 of the lighting || free be

tion lights up

No. 6 No. 2 behind

behind behind behind

a spec

Behind

one and

one 2–3 cm 2–3 cm troscopic

through water

conc. Aluminum unpure blue visible lighting solution red glass glass plate plate tet lights plate illuminated illuminated illuminated

tet

Later experiments gave a very similar result. From the table it is clear that the rays, which

KRUSE: Journal for Hygiene 19, 1895, p. 322, chap. 4.

pass the blue glass to have a more powerful effect than the red ones. But the difference does not seem to me to be so great as to permit the author to conclude that "of the rays of the spectrum the most refractory rays are chiefly responsible for the antiseptic action of light," for an action of light of 15 -16 hours passed through the blue glass plate corresponds to an effect of the red rays of 20 hours; this is not a big difference.

I shall go into more detail on BECK and SCHULTZ's work (November 1896), since it is the newest in this field and offers a good example of how such attempts should not be made. Nevertheless, the authors invalidate all previous attempts because they were not carried out with a monochromatic light.

For their experiments, BECK and SCHULTZ mostly used pigment-forming bacteria cultivated as line cultures on agar in test tubes; these were placed in boxes, the only opening of which was closed with light filters; the fluids of which were those given by Landolt, which produce as far as possible monochromatic light, that is, light consisting of rays lying quite close together in the spectrum. The use of such fluids would be highly advisable if the rest of the experiment were arranged in accordance with it. The more the light becomes monochromatic, the more rays are cut off, in other words, the less its intensity; this can only be remedied by strengthening the light source; but BECK and SCHULTZ used only unconcentrated light: diffuse daylight, direct

BECK and SCHULTZ: About the influence sucked. monochromatic light on bacterial development. journal f. Hygiene, 23 vol., 1896,

p. 490.

Sunlight and Auer's gas incandescent light, which was also greatly weakened by absorption and reflection because the light passed 2-3 light filters in a row. Diffuse daylight only has a slight bactericidal effect; of course, if one takes away so much of this light through light filters that only a small fraction remains, one has no reason to expect that this remainder could harm the bacteria.

Shouldn't the direct sunlight be so strong that even a small part of it could weaken the growth of bacteria? One can only judge of this by knowing the strength of the applied sunlight, but one has not measured it; the authors only say that the experiments were made in spring and summer. But even when using the very strongest direct sunlight, there is one circumstance which greatly limits the prospect of any strong effect from it; Of course, the boxes with the cultures were placed at a window facing south (the same was often closed), but the authors do not say that they were on a heliostat, or at least rotated according to the sun; hence it is possible that the test-tubes were illuminated only a very few hours of the day, and probably that they were not placed squarely on the rays of light.

The entire technique is such that no harmful effects on bacteria could be expected in advance.

The results of the experiments are quite unclear; I give an example here.

Experiments with Micrococcus prodigiosus.

1. In test tubes, 3 days, lots of sunshine.

Formation of the dye

Dark.

Red light

+ +

It +

blue light .

yellow

+

green

sunlight

almost undyed. 2nd plate culture, 3 days, lots of sunshine.

Formation of the dye

Dark.

blue light

+

green

yellow

red

sunlight

colourless. The colors are classified according to their effect; + denotes "no or the slightest influence on the production of dyes, i.e. the best developed colony", + denotes a stronger and - the strongest effect of the light. One gets an idea of the author's lack of logic by comparing the quoted sentence with the following quote: "In judging the influence of light on bacteria, one must not identify dye production with growth." the development of such bacteria and their pigment formation are two different things.” This remark is undoubtedly very correct, but nevertheless the authors in the description of these experiments only mention the pigment formation of the development of the bacteria and say nothing at all about the nature of the growth.

The summary of the authors of the paper is as follows: "As can be seen from our experiments, no colored light has a development-inhibiting or killing effect on any of the examined types of bacteria."

For the sake of clarity, I have presented the results of earlier investigations in a scheme; + denotes bactericidal effect, no effect, o means that the type of radiation concerned has not been studied.

Ultraviolet

+

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Downes and Blunt 1877

Fatigati 1879.

Arloing 1885

Luebbert 1886 .

Janowski 1890

Santorini 1890

Rasp 1891

Odle 1892

Kotlyar 1892

Chmelewsky 1892

Buchner 1893

Ledoud-Lebard 1893

Marshall Ward 1893

Dieudonne 1894 ·

d'Arsonval and Charrin 1894

Billings and Peekham 1895

Cruse 1895

Beck and Schultz 1896

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criticism of previous studies.

The earlier investigators used on average fairly weak light sources. It goes without saying that if you divide the light and let each part work on its own, you have to amplify the illuminator to get the same effect in the same amount of time. This seems to be the case now not to have appreciated her investigators. However, ARLOING concentrated the light through a glass lens as far as I can understand into parallel rays, but his light source was nothing more than a strong gas flame, i.e. such a weak light that one -- everyone

a priori it must be considered unlikely that it should have any discernible effect on bacteria if part of it has been removed by colored liquids.

Other investigators needed diffused daylight and Auer's gas incandescent light; these too are too weak. The only sufficiently strong light sources are sunlight and powerful electric arc lamps. Sunlight is indeed the strongest source of light, but, at least in our climate, too variable to be applied to a long comparative series of experiments. Some authors used electric arc lamps, but only GEISSLER and DIEUDONNÉ gave the luminous intensity (respectively 1000 and 900 normal lights); this is too dim light.

The authors' lack of concern for the physical side of the problem is also shown in the fact that almost none of them measured the chemical action of their illuminant, or, if they used artificial light, its strength and the distance of the culture from it; they only stated that they z. B. applied direct sunlight; but its chemical power is, of course, very different according to the degree of latitude, the time of the month, and the time of day when the experiment was carried out. Anyone investigating the bactericidal power of heat will certainly measure the temperature; in corresponding investigations of light, measuring its strength has not hitherto been considered necessary; but it seems to me equally necessary in both cases to measure as accurately as possible. Measuring the light is particularly necessary when no bactericidal effect of all components of the light can be demonstrated. In that case one cannot conclude, as all authors do, that the components which give no reaction actually have no bactericidal action; one can only conclude that these ingredients have no effect in the light of the intensity employed; in the more vigorous light they may have significant bactericidal ability. Only when the light intensity has been measured can one judge whether the result of the experiment is reliable.

In addition to strong lighting, there is another main condition for obtaining an accurate result: that the light has the best possible conditions for penetrating even the deepest layers of the bacteria's food substrate. The older investigators in particular did not fulfill this condition. ARLOING z. B. needed a broth culture in glass flasks; some of the other investigators have used cultures in test tubes; of these, as well as of the flasks, it is true that when using flowing nutrient medium or prick culture, a large part of the chemical rays is lost by absorption in the nutrient medium, and this acts like a converging lens, so that only a wedge-shaped part lying in the middle of the glass of culture is illuminated.

The defects pointed out make it understandable why no fewer than three of the earlier investigators have found no effect of the colored light at all, and why so few have noticed an effect of the feebly refracting rays; for if one arranges the experiment in such a way that the sum of all components of the light either does not harm the bacteria at all or only to a small degree, it is of course even less possible to demonstrate a bactericidal capacity in the individual qualities of the rays, especially in the less powerful ones , even if they in fact possess the same. The only way to get an accurate result is by using such powerful light, and letting it act on the bacteria under such favorable conditions, that even the least effective rays can produce a marked reaction.

Own attempts.

I already carried out the present experiments in the spring of 1897. As a result of the rapid development which the technical aids of Finsen's Medical Light Institute underwent, it is quite inevitable that they now appear somewhat outdated. Nevertheless, I have decided to publish them in a foreign language as well, because, in spite of their shortcomings, which I see well enough, they seem to me to be a step forward compared to earlier work in this field. It seems to me that I have proved more precisely to which spectral regions the bactericidal effect of light is essentially bound than earlier investigators have done, and I have also made a first attempt to make this relationship the subject of a quantitative investigation, by proving how big the difference is between the effect of the different spectral ranges.

The numerical values that I found cannot claim to be considered accurate. The accuracy of such an examination suffers from not having reliable means of comparing the intensity of light in different parts of the spectrum.

With the physical employee of the "Light Institute", Mr. cand. mag. ABSALON LARSEN, I have attempted to make a measurement by means of Vierordt's and Glahn's spectrophotometer; but since none of them gave useful results in the blue and violet, and of course they cannot measure ultraviolet at all, i.e. precisely the regions that are important, I had to refrain from making such a determination.

I have worked with Bacillus prodigiosus in this series of experiments. I chose this because we always use it at the "Light Institute" (see Finsen's book "About the Application of Concentrated Chemical Light Beams in Medicine", Leipzig 1899, p. 21 etc.), and because it is often used here and elsewhere compared to other bacteria without being able to discover any essential difference, so that its reaction can be considered typical. As a light source I used an electric arc lamp of 35 amps, 46-44 volts, about 6000 standard candles. The automatic regulation mechanism is supported by an adjustable rheostat in order to keep the current setting as accurate as possible.

I have concentrated the light by means of an apparatus roughly like that described in Finsen's above-mentioned book, p. 20. It consists of glass lenses set in a brass tube; in one end of the apparatus are three plano-convex glass lenses; the one closest to the light has a diameter of 1634 cm; all together act like a single lens with 15 cm focal length

wide. The apparatus is suspended such that its axis forms an angle of 45° with the direction of the carbons and that the positive carbon tip is just 15 cm from the nearest lens. The three associated lenses will then gather into parallel rays all the rays emanating from the lamp which strike them; these pass further through the brass tube, and meet at the other end of it a duckweed (a layer of water trapped on the sides of the brass tube, at the ends of two large watch-glasses); the thickness of the water layer is 17 cm at the edge of the lens; this duckweed collects the parallel rays to converge. As the light passes through the water layer, it is cooled by the water absorbing one of its warmest components, namely the ultra-red rays; this ensures that the bacteria are not so easily killed by the heat.

Since there is no actinometer which can measure concentrated light, I had to make a detour when measuring the luminous intensity. I cut strips from a piece of photographic paper (Aristo paper) and illuminated them partly with the concentrated light at a spot where the cultures were placed, partly with unconcentrated light at a certain distance (18 cm.) from the charcoal tips, and at such a height that the paper was struck by the strongest rays of light, from those which make an angle of about 45° with the horizon. The paper was held behind a photographic instantaneous shutter. The difference in chemical action was proved by trying how many times I should act the instantaneous shutter to keep the same blackening of the paper by unconcentrated light as that which appeared when I

he

:

opened it twice in the concentrated light. Having proved this relation, I had only to measure the unconcentrated light at the same point as before with Vogel's photometer to be able to state the intensity of the concentrated light in one of the actinometric measures commonly used.

When I say that I have measured the intensity of the concentrated light, that is not strictly correct; it cannot be done at all, as the marginal rays have a far weaker chemical action than the rays in the middle of the cones of light. My measurement only applies to the center of the light cones. The time of illumination was so short that these rays produced just a perceptible blackening of the paper when the instantaneous shutter was opened twice; the marginal rays made no impression at all.

The little blackened patch produced by the concentrated light was cut out; also pieces of the same size were cut out of the pieces of paper which had been exposed to the unconcentrated light at different times; then they were compared in a dark room under incandescent light. The paper pieces were observed through smoke-tinted glasses to correct for any slight color difference. A difference from approximately 1/2 second exposure to unconcentrated light was clearly discernible.

It turned out that the paper had to be illuminated in unconcentrated light io times as long as in concentrated light in order to obtain the same degree of blackening; as the effect on the paper is proportional to the time of illumination, the chemical effect is consequently 1:10.

On the paper in Vogel's photometer, No. 12 was clearly distinguished, and to some extent No. 13 and No. 14 could just be seen; I usually calculate this effect as No. 14 (27.88 light units). I exposed 1 minute and used filter paper dipped in a 4 inch solution of bichromate of potash; the paper was freshly prepared.

Thus, the intensity of the concentrated light at the place where the cultures were placed corresponds to 10x27.88=279 Vogel's light units. Because of the many sources of error, this result cannot, of course, claim to be accurate. For comparison I mention that the highest intensity of sunlight I found in the summer of 1898 was 57 units for a 1 minute exposure.

I used agar for the food substrate for the bacteria. The lighted cultures were plate cultures, prepared in the usual manner at 45°C. in square mean flasks. 2 cm of agar was found in each flask and 2 pilets of a prodigiosus broth culture were sown therein. The area on which the agar was spread is 7x13'1 cm; the thickness of the agar layer is about "2 mm over the largest part of the surface; about 2 mm at the edge, where the adhesive force acts.

Once the agar had set, the bottles were placed on ice. Since Bacillus prodigiosus can grow a little under these conditions, I only left the bottles for a limited time before beginning the experiment, at most 3 days in winter and 12 hours in summer.

Before the experiment I painted a number on the bottle with asphalt paint, which indicated the duration of the experiment; last I pushed a metal case with a round hole from

a couple of centimeters across the bottle so that the number was in the middle of the hole. The bottle was placed in a rack so that it was perpendicular to the axis of the light cones, within focus at the point where the light cones were 2"/2 cm in diameter. To prevent the bottle from heating up,

To prevent this, cold water was sprinkled over it by an irrigator throughout the experiment.

When the experiment was finished - in short experiments the time was measured with a chronograph showing 15 seconds - the bottle was placed in a dark room at room temperature. When the culture had grown, if it was illuminated long enough, vigorous growth was found where the figure and the metal case had covered it, but weak growth, or perhaps none at all, on the illuminated part of the culture, that is, on that part , which corresponded to the hole in the sheath, and was not covered by the number. This difference in growth caused the number to stand out clearly so that it could be seen with the naked eye.

In addition to the clearness of the reaction, this method has the advantage of protecting against the two main sources of error, poor preparation of the culture and excessive heating during illumination. The former defect is recognized by the growth being poor in that part of the culture which was protected by the metal case; the latter by the bacteria being killed below the number; Excessive heating during the experiment is prevented by sprinkling cold water over it.

The order of experiments used has not a few advantages over that of the earlier investigators: the light is constant, containing rays with shorter wavelengths than any Finsens medical light institute. other artificial light that could come into consideration (Auer's gas incandescent light, for example), and is sufficiently powerful that one can even demonstrate the influence of the most weakly acting rays; the disruptive effect of heat rays is excluded; each unit of area of the culture is always hit by a certain number of units of light; the preparation of the culture ensures a constant resistance of the bacteria; the thickness of the agar layer, which is always the same, is so small (about 12 mm) that its absorption plays almost no role; the detection of even the weakest reaction is very easy.

I produced the different parts of the spectrum by placing a 3 cm wide light filter (a vessel with parallel, flat glass walls) filled with different liquids between the concentration apparatus and the bacterial culture.

I made two sets of determinations: 1. how much time it takes the different spectral sections to kill the bacteria, 2. how much time they take to elicit the weakest detectable response, i. h, to weaken the lighted part of the culture around the number so much that it grows slower than the unlighted part below the number. The number then becomes just visible on the culture, owing to the difference in growth. If the lighting lasted for such a short time that the difference in growth is very small, it gradually disappears so that the number becomes invisible. So I read several times how the culture gradually grew.

I only made these two series of determinations when the light filter was filled with distilled water and thus let the qualities of rays pass that had actually passed through the concentrating apparatus.')

I then made the same determination when the filter was filled with different liquids, each of which allowed only a definite part of the spectrum to pass a shorter or longer distance from the extreme left end of the same to the right. For this I used 1. a 1% solution of sulphate of quinine, with the addition of a little sulfuric acid, 2. a 5% solution of nickel sulphate, 3. a 11/26 solution of monochromate of potash,

4. a 1 1/2° solution of dichromated potash and 5. a %°. aqueous solution of fuchsin. I have always used a fresh quinine solution as the strong light quickly turns the solution yellow, probably due to the conversion of the quinine to the yellow quinidine. However, the solution did not turn yellow during the experiment.

The electric arc light and the fluids used are with Mr. cand. mag. ABSALON LARSENS assistance with Vierordt's spectrophotometer.

0 0

I) It could wonderfully happen that the response time, which I

found is not the same as that of Finsen (see Finsen: On the Application of Concentrated Chemical Light Rays in Medicine, p. 26); but it must be remembered that it is a matter of opinion whether a number is clear, and whether the bacteria around it are killed. While Finsen only called the bacteria weakened when the number was very clear, I used a number as a criterion that one could only just see; and while Finsen called the bacteria killed when nearly all were killed, I have required that they should be killed to the edge of the lighted spot and not grow out in the course of a week or so. As a result, Finsen's reaction time for weakening the bacteria is faster and his reaction time for killing the bacteria is slower than mine. Nobody makes a mistake here; all that matters is that the reading be the same over a series of trials.

>

red

385 ule

385 ull

450

475

425

400

Vixen

dichromate of potash

monochrome acid potash

p. 68 there is a drawing of the spectroscopic conditions. On this I must remark that, as it is to some extent a matter of opinion what name one chooses to give a colour, the boundaries between the colors of the spectrum are far from being sharp, as in the drawing; especially the transition between blue and violet is quite indefinite. So it is quite arbitrary where to draw these lines; I marked them out according to Müller-Pouillet's textbook on physics.

As neither concentrated light nor direct electric light can be spectroscopically observed, I transformed this into diffuse light by letting it fall on a frosted glass screen placed 50 cm. from the lamp used for the experiments, at right angles to the strongest rays of light . Turning Vierordt's spectrophotometer toward the illuminated portion of this screen, it is found that the outermost visible red rays have a wavelength of about 760 uu (millionths of a millimeter); from here the spectrum continues uninterrupted by the visible types of rays up to the rays of wavelength 434 γų at the transitions between blue and violet; from 434 uu to 426 uu the spectrum is more faint; the rays of wavelength 426 uu to 418 uu, on the other hand, form a very bright band; from here the spectrum is again faint up to the wavelength 395 uu; before 395 uu to 388 qu it is dark, and ends with a light band from 388 uu to 385 uu; however, this band is so faint that it is just visible. Whether the light that has passed the concentrating apparatus contains rays with a wavelength even shorter than 385 uu I have not been able to prove with the available tools, but one can consider it probable because electric arc light contains such rays, and because glass, after MüllerPouillet's textbook of physics, allows rays up to 350-300 uu wavelength to pass.

The different wavelengths were found by examining the position of Frauenhofer's lines in relation to the scale of the spectroscope.

Placing a light filter with water in front of the slit does not alter the relative spectroscopic relationships to any appreciable degree. The absorption ratios of the liquids used will be seen from the attached drawing; only I must remark that there is the difference between the spectrum of quinine sulphate and that of nickel sulphate, that while the quinine sulphate only slightly weakens the light band lying between 426uu and 418ļu, the nickel sulphate weakens it very much; this difference in the spectra is not seen in the drawing, which does not give the quantitative proportions.

Considering the usual ratios of the absorption spectra, one may assume that the substances which absorb the violet rays do not allow the ultraviolet ones to pass either.

In order to find the time required for the rays passing through the liquid in question to kill the bacteria and stun their growth, I first examined the effect of two arbitrary times of illumination, and gradually narrowed the interval between them, until I found the response time I was looking for; I checked this again by illuminating a culture in the found and in a slightly shorter time a few times.

In the following overview I have presented the numbers found in this way together with the spectroscopic conditions.

Because of the long duration of such an experiment, I have not investigated how long it takes for the red light to killing bacteria. The light which passes through dichromated potash completely kills the bacteria after 8 hours of illumination for 10 hours; in order not to make another long attempt, I set the time to about 9 hours. All the other times have been checked by several attempts in the given time and in a slightly shorter one.

Looking at the scheme on page 72 and the drawing of the spectrum on page 68, one sees the following:

All the separate parts of the spectrum, excepting the ultra-red, which I left out of account, have an injurious effect on bacteria, but in varying degrees. The effect appears to increase fairly uniformly from the red towards the ultraviolet end of the spectrum. These investigations do not show where the maximum effect lies.

The boundary between the chemically active part of the spectrum (blue, violet and ultraviolet rays) and the non-chemically active part (red, orange, yellow and green rays) corresponds approximately to the right limit of the absorption spectrum of monochromatic potash. By comparing the action of the light which has passed through the monochromatic potash (Field IV) and the action of all the components (Field I) of the spectrum, the main thing is settled: how much of the bactericidal action on the chemical rays, and how much is based on the non-chemical ones. The non-chemical rays bring about a significant weakening of bacterial growth during an exposure of 6 minutes; the whole spectrum causes the same effect for 1/4 minute, so it acts 24 times as powerful; if the action of the non-chemical rays, ie, the red, orange, yellow, and green rays, be set at i, then the action of the whole spectrum = 24, consequently that of the

chemical rays, ie the blue, violet and ultraviolet =23. Both sets of light rays, both the

Chemical and non-chemical rays (not counting the ultra-red rays excluded by the concentration apparatus) therefore inhibit the growth of bacteria, but in very different degrees, in that only about 4% of the inhibiting effect is on the non-chemical rays, and about 96% on the chemical ones As has been said above, these figures must not be considered exact, but at least one can conclude that the vast majority of the effect is due to the blue, violet and ultraviolet rays.

As can be seen in the summary table on page 57, it has hitherto been very doubtful whether red, orange, yellow and green light rays are harmful to bacteria at all. From my experiments it appears that this is indeed the case. It is not surprising that earlier investigators could not come to any reliable conclusions regarding the effect of these spectral parts, when one sees that, despite the use of extraordinarily strong light, I had to expose the bacteria to these types of radiation for a long time in order to at all to make a noticeable impact. Pure red light elicited the slightest discernible delay in growth even after 1'' hours of illumination. Considering that this response was achieved by illumination with all components of the spectrum during ½ minute must be 1'2 hours be considered for a particularly lengthy illumination.

The light that has passed through the quinine sulphate solution inhibits the growth of the bacteria by an exposure of 3. minutes, that which has passed through the nickel sulphate solution only inhibits the growth by an exposure of 3 minutes. These two kinds of light cover the same spectral region 760-418 uu, and there is none at all

other marked difference between their spectroscopic relationships, than that of the band between 426 and 418 uu mentioned before being bright in the spectrum of the quinine sulphate and faint in that of the nickel sulphate. The great difference in effect then doubtless rests largely on the different luminous intensity of this band. This ratio is a striking example of the importance of the light whose bactericidal power is used therapeutically being as luminous as possible in its blue-violet-ultraviolet part.

Outside the mentioned band from 426 to 418 uu the spectrum is faint from 418 to 395 uu and dark from 395 to 388 uu; between 388 and 385 uu lies a faint streak, which is the most visible. Outside of this there are finally the invisible ultraviolet rays, which probably extend quite a bit, up to 350-300 ḷu, but whose extent and proportion I could not prove.

The effect of these two faint bands, as well as the (unmeasured) ultraviolet rays, is discovered by comparing the effect of light that has passed through distilled water with the effect of light that has passed through quinine sulphate. Part of the difference may be due to the albeit insignificant weakening of the band lying between 426 and 418 uu on passage through the quinine sulphate solution.

In spite of the faintness and the small extension of the two extreme bands and the strong absorption of the glass of ultraviolet rays, this extreme part of the spectrum has a powerful inhibiting influence on the growth of bacteria. How much of the effect is to be attributed to the two violet stripes mentioned, and how much to the ultraviolet rays, cannot be determined without knowing the extent and number ratio of these rays, or one would have to be able to use a substance as a light filter, which it annihilates without taking some of the visible rays with it. To my knowledge, however, such a substance does not exist.

Incidentally, I want to draw your attention to the fact that the field of ultraviolet rays cannot be precisely delimited; There are individual differences in the ability of the eyes to perceive the extreme violet rays, 1), and the ability of these rays to make an impression on the eyesight varies according to the nature of the light-giver, which, like any other impression of light, depends on the proportion of the radiation dependent. Sunlight, for example, can only be seen up to Frauenhofer's line H, (393 uu) in the spectroscope I have used; at about the same point begins the dark band in the spectrum of electric arc light; the light band, which is further out, between 388 and 385 uu, corresponds in wavelength to the invisible ultraviolet rays of sunlight; that these rays are only visible in the spectrum of electric light

1) WIDMARK proved that the limit for the extreme visible

violet in the electric arc light the following important individual

dual vibrations, but does not vary particularly with age

stages under 50-55 years:

Maxim. minimum

Aged 11-20 years: 378-395 uu on average 386 uu

21-30 371-395

382.5

31--40 372.5-393

382.9

41-50

380.5-394.5

388.7

(JOHAN WIDMARK: Om grins for the synliga spectrum. [About the
limit for the visible spectrum. Öfversigt af Congl. Vetenskaps-
Akademiens Förhandlingar 12. May 1897, No. 5, p. 287.)

It agrees well with these studies that cand. Larsen and I, both of whom are in the 21-30 year age group, saw uu until about 385. None of us knew about Widmark's investigations at the time.

11

probably due to the fact that more rays are accumulated in the electric light than in the sunlight at this point,

In addition, in judging the action of the ultra-violet rays, it must be borne in mind that the light has passed through thick layers of glass, which absorb all rays of a wavelength shorter than 350-300 u.u. which may be present in the arclight. It is, indeed, possible to examine the effect of concentrated light, which contains rays of still shorter wavelength, by collecting the light with lenses of rock-crystal instead of glass; because rock crystal allows rays with a wavelength of up to 200 qu to pass. But at the time these experiments were made the Institute did not yet have collecting apparatus with rock-crystal lenses, and so I had to postpone an exact determination of the effect of this spectral region until another occasion.

So far I have only calculated the time that the light needs to weaken the growth of the bacteria. From Table I it will be easy to see that the relation between the effect of the different parts of the spectrum becomes slightly different when calculated according to the time it takes for the light to kill the bacteria, although the main thing: the predominant influence of blue, violet and ultraviolet rays remains unchanged. Why this is I cannot say; there are several possibilities which cannot be surveyed on the basis of the present investigations. 1) The whole relationship with the bactericidal effect is easily understood by the above considerations.

1) In large part it is certainly due to the various bacteria

killing powers of the marginal rays and central rays of the cone of light, being able to discern the slightest weakening of the bacteria when the number in the center of the exposed spot stood out; on the other hand, I only regarded the bacteria as killed when they were also killed on the edge of the exposed part. (Compare p. 63).

resume.

1. All the rays of the spectrum, from the red upwards, except the ultra-red, which have not been examined, check the development of bacteria. Whether the red rays are capable of killing the bacteria has not been directly demonstrated; all the other parts of the spectrum have the ability to do so.

2. The effect increases with the refraction exponent.

3. The effect is mainly due to the blue, violet and ultraviolet rays.

4. These results apply to the Bacillus prodigiosus and to the particular light I used (the light from an electric arc lamp of

35 amps and 46-44 volts, concentrated by the described Finsen light-gathering apparatus).

About the power of light, scion

and kill mold

from

Valdemar Bie.

the

ie knowledge of the effect of light on shoot and

Mold fungus has been very low until very recent times; it has usually been assumed to have the same effect on these organisms as on other plants. In the following I give some results of the earlier investigations.

DE BARY (1863) discovered no effect of light on the growth of Peronospora species; on the other hand, he found a favorable effect on the development of Uromyces appendiculatus. If he sowed his spores on bean leaves that were only lit from one side, they grew out on the lit side first.

VAN TIEGHEM (1881) proved the same in relation to Penicillium glaucum; in a flask of spore oil, this fungus grew in such a way that its contour formed a regular curve, the apex of which corresponded to the middle of the side of the flask which was toward the light; on the opposite side the mycelium did not develop at all or hardly at all. If porous, moist, baked clay was placed in a bottle with spore-containing oil, the fungus also only grew on the sides of the clay that were exposed to the light.

DE BARY: Research on the development of quelques champignons parasites. Annales des sciences naturelles p. IV Botanique T. 20, 1863 p. 54 and 98.

VAN TIEGHEM: Action de la lumière sur la vegetation du Penicillium glaucum dans l'huile. Bulletin de la Société botanique de France 1881

p. 186

VAN TIEGHEM (1884) and WINTER (1874) are even of the opinion that light is necessary for the development of the mycelium of Pyronema confluens and Pesisa Fuckeliana de By.

KNY (1884) discovered no influence of light on the speed of reproduction in Saccharomyces cerevisiae,

None of these authors have demonstrated that light is capable of killing sprout and mold fungi.

ZOPF was therefore able to rightly remark the following in 1890: "Direct sunlight appears to have a slightly fatal effect on the thallus of most saprophytic molds and basidiomycetes, apparently as a result of the rapid drying caused thereby. Whether sunlight itself can have a deadly effect, similar to certain fissure fungi, remains to be investigated.”

Zopf seems to have overlooked one study, namely that of DOWNES and BLUNT from 1878 and 1879.

VAN TIEGHEM: Culture et development du Pyronema confluens. Bulletin de la Société botanique de France 1884 p. 356

WINTER: Heliotropism at Peziza Fuckeliana de By. Bot. Newspaper 1874 p. 5. Ref. after F. Elfving: Studies on the effect of light on fungi. Helsingfors 1890 p. 13.

KNY: The relation of light to cell division in Saccharomyces cerevisiae. reports d. German botan. society II 1884 p. 129. Ref. after Elfving I. cp 15.

Zopf: The fungi in morphological, physiological, biological and systematic relationship. Wroclaw 1890 p. 219. Ref. after Elfving.

Downes and BLUNT: Researches on the Effect of Light upon Bacteria

These authors, the creators of the teaching of the ability of light to kill microorganisms, have subjected all relevant questions to an excellent thorough examination. They observed that when unboiled Pasteur liquid was illuminated, fungi never grew in it during this procedure, even when placed in the dark after prolonged exposure; but if the liquid was placed in the dark or in diffused daylight after a shorter period of illumination, mushrooms grew out in several cases, but no bacteria.

From this Downes and Blunt conclude that light retards or even prevents the development of those microscopic fungi which are concerned with putrefaction and decay, but that it has a lesser effect on these organisms than on bacteria.

In recent years, numerous investigations have been carried out, which, however, have not produced any reliable results.

GAILLARD studied Oidium albicans and levure rouge by sowing them in bottles of broth and placing the bottles in sunlight during the day and in a refrigerator at night.

Oidium was not affected by this, some cultures even grew during the illumination. No clear difference could be found on solid food substrates either, regardless of whether the culture was in a light or a dark place.

The red yeast also grew out during the lighting;

and other organisms. Proceedings of the Royal Society of London vol. 26, 1878 p. 488

Downes and Blunt: On the Influence of Light upon Protoplasm. Proceedings of the Royal Society of London v. 28, 1879 p. 199

G. GAILLARD: De l'influence de la lumière sur les Microorganismes. Thesis. Lyons 1888.

one of the cultures even appeared to have grown much more than those that had been in control in a dark thermostat.

On solid food substrates, colonies always appeared clearer and thicker in direct or diffuse sunlight than in the dark.

According to Gaillard's investigations, sunlight favors the development of the two species mentioned,

LAURENT exposed spores of Ustilago carbo in glass flasks to direct sunlight. After 8 hours of illumination in July, the spores had died while those serving as controls developed normally. These spores were much easier to manipulate than the spores of Aspergillus niger and glaucus, Botrytis cinerea and Cladosporium herbarum. Spores of Penicillium and Cladosporium were also killed by the light, the former more easily than the latter.

ELFVING discovered that intense summer sunlight prevented Aspergillus glaucus spores from germinating but did not kill them, even after 8 days of exposure. The fungus was easily destroyed by light after germination in the first stages of development; fully grown mycelium, on the other hand, could be exposed to sunlight for several days without dying. The spores behaved in the same way: those just laid were killed by the sunlight in a day; the tires could be isolated for several weeks without damage.

MARTINAUD tested the Light's ability to injure Sac

LAURENT: Influence of the light on the spores of Charbon des Céréales. Comptes rendus Soc. royal de Botanique de Belgique t. 28, 1889 p. 162, ref. after Elfving 1. cp 19.

F. ELFVING: Studies on the action of light on fungi. Helsingfors 1890 p. 105

MARTINAUD: Influence des rayons solaires sur les levures, que l'on renFinsens medical light institute.

charomyces apiculatus and Saccharomyces ellipsoideus I and II by illuminating either freshly picked grapes immersed in sterile water in which he had suspended shoot cells, or a sterile glass plate or paper treated in the same way. After the illumination, an attempt was made to see whether the germs grew in sterile wine must.

It turned out that the germs were killed at 41-45° C. after 4 hours of lighting, at a low temperature only after longer lighting.

MARSHALL WARD used the procedure described in my previous paper.

He showed microbicidal action on the following species: Oidium lactis, Chalara mycoderma, Saccharomyces pyriformis and a Stysanus. On the other hand, the following species gave a negative result: Aspergillus glaucus, Penicillium crustaceum, Mucor racemosus, Nectria cinnabarina and Botrytis cinerea.

Marshall Ward points out that all of the species that gave a positive result have hyaline, colorless or very faintly yellowish spores, while all of the species that were unaffected have distinctly pigmented spores.

I will not elaborate on a critique of the authors' approach, as it would essentially be a repetition of what I have already stated in my previous paper. I have to draw attention again to the fact that the chief error of earlier attempts of this kind is the use of too weak a light and the want of light measurements.

It goes without saying that you have to use light of a certain intensity in order to produce a clear difference between growing mushrooms in the light and in the dark. It is no less necessary to measure the luminous intensity. One may speak just as little of light as of heat in general; As it is self-evident that in experiments with the bactericidal effect of heat the temperature is measured, in experiments of the same kind with light one must of course state the intensity of the same. If this is not done, it is impossible later to judge the value of the experiments, partly because it is not certain that the micro-organisms will react equally to all intensities or types of light.

I emphasize this because I can see that in experiments with the strongest light available to me, the influence of light on the growth conditions of the microorganisms in question was not exhausted; it will doubtless also be of interest to try the effect of weaker light.

The procedure in my experiments was mainly the same as that described on p. 60, etc., only I took into account one result of my earlier experiments, namely the strong action of the ultraviolet rays. In order to utilize this as much as possible, the concentrating apparatus with glass lenses described on p. 61 has been replaced by one with lenses made of rock crystal, which allow far more ultraviolet rays (see p. 76) to pass through, and instead of culture bottles I have bowls made of made of a rock crystal plate set in a brass ring. By the way, no significant changes were made in the construction of the concentration apparatus. Like the one previously described, it consists of two sets of lenses set in a brass tube; next to

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contre à la surface des raisins. Comptes rendus de l'Académie des sciences t. 113, 1891 p. 782.

H. MARSHALL WARD: Further Experiments on the Action of Light on Bacillus anthracis. Proceedings of the Royal Society of London vol. 53, 1893 p. 23

the light are two lenses of 612 cm in diameter and 30 resp. 20 cm. focal length, which is placed at a distance of 12 cm. from the lamp, which collects the divergent rays radiating from it in parallel; at the opposite end of the brass tube are mounted two lenses, which gather the parallel rays of light into convergent ones, and enclose between them a 30 cm. thick layer of distilled water, which cools the light by absorbing the ultra-red rays.

The electric lamp burned at 45 amps and 50-45 volts (about 10,000 standard lights).

I prepared the cultures by scraping off some of the surface culture, suspending it in wort, filtering through hygroscopic cotton wool and mixing the filtrate with wort agar , which was then evenly distributed in the dishes. However, I could not scrape anything from the Aspergillus niger culture, so I had to make the suspension by shaking the culture with wort and then filtering. During the lighting, the bowls were placed outside the focus of the concentrator, at the point where the cone of light has a diameter of 57 cm.

After the illumination was terminated, the dishes were placed in the dark and converted into humid chambers by placing them, bottom up, on damp filter paper. I believe I have avoided confusing the effect of light and heat. I have

the same precautionary measure as used in the previous series of experiments: sprinkling with cold water. I also attached the bowl without a background in a bracket; although the light is very warm, under these conditions it passes through the culture without absorbing many rays of heat; I have convinced myself through control experiments that a 10% gelatine, whose melting point is around 27° C., does not melt as a result of the process used, even if it is illuminated without overflow.

MARSHALL WARDS investigations, the most detailed and reliable that have been made up to now, give the result, as stated on p. 82, that not all species of mold and sprout are killed by direct sunlight. Whether this was due to the light being too weak, or to the fact that some species are not in fact harmfully affected by the light, cannot be judged, especially as the intensity of the sunlight has not been measured. In such cases of doubt, the advantage of using concentrated light of such intensity that one can conclude that it can produce a positive reaction in all cases where such a reaction can be produced at all shows itself to be advantageous. Through the application

By such light I have proved that in every case the few species which I have examined are stunted, and, if exposed long enough, are killed.

I have 1. Saccharomyces apiculatus, 2. Monilia candida, 3. a red pigmented Torula species, 4. a Cladosporium species, 1)

1) Prof. Dr. phil. Emil Chr. Hansen, Director of the Physiological

Department of the Carlsberg Laboratory, has shown me the kindness of identifying this species by microscopic examination.

which forms brownish black pigment, and 5. Aspergillus niger examined.

Regarding these 5 types, my experimental journal contains the following:

1. Saccharomyces apiculatus. 111 illuminated for 30 minutes

killed. 20

19

23

U.N

9

.

5 4

not quite killed. 3. A Torula - Art. 12 lit for 30 minutes

killed. 20

not killed.

.

.

71

.

.

12

3

29/

3

73 illuminated for 20 minutes

. not killed. 30

killed.

25

not killed.

4. A Cladosporium species.

242 illuminated for 30 minutes

killed.

15

not killed.

.

5

3

20

71

13 10/

3

25

12.30

killed.

311

3

2014

29/

2

5 9

5. Aspergillus niger. Illuminated for 60 minutes

not killed. 90

killed.

go

75

not quite killed. 60

not killed. The fact that a repetition of the experiments always gave the same result, with the exception of two cases (Saccharomyces apiculatus 23/4 minutes and Monilia candida 14/15 minutes) seems to me to speak for the accuracy of the method of investigation.

From the test journal it can be seen that Saccharomyces apiculatus after 5 min but not after 4 min Monilia candida

5

4. Torula

30

25 Cladosporium

25 Aspergillus niger

75 to be killed.

A time of illumination intermediate between the two times quoted is the accurate expression of the time in which the light under these conditions kills the species in question.

For comparison, Bacillus prodigiosus is reported to be killed in approximately 1 minute under the same conditions

and is apparently weakened by 2-1 second illumination.

It is clear from my experiments that

1. that the investigated species of sprout and mold can all be killed by a sufficiently strong light,

2 that their power of resistance to light is much greater than that of Bacillus prodigiosus (and the other bacteria examined at the Light Institute, cf. p. 93), as well as

3. that the resistance is significantly greater in the pigment-forming species (Torula, Cladosporium and Aspergillus niger) than in the non-pigmented ones (Saccharomyces apiculatus and Monilia candida).

VI.

Do different types of bacteria have the same resistance?

against the light?

from

Axel L Larsen.

u

m to be able to examine whether the individual bacteria

species have different levels of resistance to the killing influence of light, it is best to use a constant light. If you use an inconstant light, e.g. E.g. sunlight, cultures of different bacterial species can certainly be exposed to it at the same time and under the same conditions, but in this way one can only make a qualitative investigation as to whether there is a difference in the resistance of the individual bacterial species, and get a tolerable idea of the magnitude of this difference.

By frequently measuring the intensity of light some assurance is obtained, but it is not complete, as there is no actinometer which reacts quite like bacteria.

If e.g. For example, if two species that are illuminated at the same time are killed after 6 hours and the other after 8 hours of illumination, one can only conclude from this that they have different powers of resistance; namely, the last 2 hours of lighting time cannot be compared with any of the periods of the previous 6 hours.

If one wants to be oriented exactly about the conditions, one must undertake a quantitative investigation by means of a constant artificial light.

Very few of the investigators who formerly investigated the bactericidal action of light worked with an artificial, constant light, and none of them dealt with the conditions here discussed. And of those who used the sun as a light source, only BUCHNER illuminated cultures of different species at the same time, viz., Bacillus tyfosus, B. coli communis, and B. pyocyaneus; he found no clear difference between their resilience. A few others have examined different species at different times; As can be seen from the considerations above, nothing can be concluded from this.

Highly exact, comparative investigations are therefore required into the action of light on the various bacteria, and it is precisely such investigations that I have undertaken. For the time being I have examined only a few species, just as I picked them out from the large host of bacteria; but I hope later to be able to publish experiments with a larger number of species.

I have arranged my experimental technique in such a way that I can compare experiments made at different times. As for the light source first, I used electric arc light. The lamp which I employed during the experiments was of 35 amps and 46 to 44 volts, and the amperage was checked by an ammeter. I have always used the same coals to produce the light.

The light was concentrated by Professor FINSEN's collecting apparatus of older construction1). I used this apparatus for all investigations, so that the amount of light was always the same.

To further check this point, I often tried to remember how much time it took to get Microc. to kill and weaken pródigiosus, and each time this time has been constant, namely 35 minutes resp. 15 seconds.

After these clarifications I can regard it as proven that the luminous intensity has always been the same. The bacteria were seeded from broth cultures in liquid agar, which I allowed to stiffen in a thin layer on one of the inside sides of a small rectangular flask.

The same amount of agar was used for each experiment, namely 2 cc, and the bacteria were distributed as evenly as possible in it.

Seeding into the liquid agar was undertaken when it was at a temperature not unfavorable to the species of bacteria under study. A number was drawn on the outside of the bottle with asphalt paint which, when the bottle was illuminated, shaded part of the bacteria. To prevent the influence of heat, the illuminated part of the bottle was continuously sprinkled with cold water while the experiment was going on.

So the technique is the same as used by Finsen. By pouring a certain amount of agar onto one side of the bottle (bottles are all the same size), you can ensure that the light passes through an equally thick layer of agar in all experiments. Refraction of light is avoided because the sides of the bottle are flat and the corners and edges of the bottle are not illuminated at all but form part of the control unilluminated portion of the bottle.

1) VR Finsen: About the application of concentrated chemical light

radiate in medicine. Leipzig 1899, p. 19 (Vogels Verlag).

This lot, as well as the agar under the black number, has the same effect here as the control tubes in the earlier authors' studies, and is more reliable in showing the cultures to be viable precisely in the lighted bottle.

It goes without saying that the bottle was placed in such a way that the light fell perpendicularly on the illuminated part of it.

As a criterion for the bacteria being killed, I took the fact that the lighted part of the agar remained sterile even after the bottle had been in the thermostat at a temperature favorable for bacterial culture until the culture in the was not illuminated part was well grown.

Before proceeding to cite my experiments, I shall briefly explain the notations used in the tables, on one side of which are the experiments intended to ascertain how long the light takes to kill the species of bacteria examined , while the other side indicates how long the light must be left on to weaken their growth.

By "effect" I mean the inhibition of growth of the bacteria visible to the naked eye after they are illuminated. The effect is then called "just visible" when the bacteria under the black number in the shadow have grown a little stronger than the illuminated ones after a certain time, so that the difference can only be discovered by looking very closely. This difference is somewhat greater with the designation "visible effect", but not at all noticeable, which is the case when the effect is described as "clear". "Heavy impact" indicates that some of the seeded bacteria have been killed, but numerous others are still growing. Very high exposure” means most of the bacteria have been killed; if the effect is "killed", this means that none of the illuminated bacteria have grown after the culture bottle has been in the thermostat.

I would also point out that where it is necessary to examine how much time the light takes to inhibit the growth of the bacteria, one must sow densely and check the culture frequently, since the difference between the illuminated and non-illuminated portions is only can be noticed when the growth has reached a certain strength, a circumstance which, of course, gradually balances out more and more.

The following species have been examined: Bacillus pyocyaneus, cyanogenus, typhi muris, typhi, Bact. coli commune, as well as Staphylococcus pyogenes albus, aureus and citreus.

it

Number of lighting attempts time in min.

impact

Number of lighting attempts time in sec.

Hard Killed

20

3 3 5

effect

No

Just visible

Visible

Clearly

30 40

From the experiments mentioned above, which, as stated, are only part of a longer series of investigations into killed. The time given in minutes.

B. typhi muris

B. coli commune

B. Typhi

.

Staphyl. pyog. citrus

B. prodigiosus

Staphyl. pyog. albus .

Staphyl. pyog. aureus

B. pyocyaneus

B.cyanogenus

5 10 15 20 25 30 35 40 45 50 55 60

pose this question, it is evident that just because a single species is killed by the light in a given time, one cannot conclude that all bacteria behave alike. Because the time it takes to kill the species I studied varies from 25 minutes to 1 hour, so more than double. Nor can it be concluded that if one species of a given form of bacteria is killed in a certain period of time, then the other species of the same morphological group will behave alike; e.g. B. It can be seen that Staphylococcus pyogenes albus and aureus are killed after 35 minutes, while Staphylococcus citreus must be illuminated for 45 minutes.

Finsens Medical Light Institute.

According to my experiments, the time which is necessary to weaken the growth of the bacteria in general also varies somewhat, varying between 5 and 55 seconds, and for the species examined is not proportional to the time necessary for the destruction by e.g. B. Debuff on Bact. typhi muris is discovered after 10 seconds of illumination, while in order to be killed it must be exposed to the action of the light for one hour, and the times for Staphylococcus pyogenes citreus are 55 seconds, respectively. 45 minutes are

From my experiments, shown graphically above, it follows:

1. Different species of bacteria are affected differently by light, and even between closely related species the difference can be significant.

2. The time taken by light to kill a given species of bacteria is not in constant proportion to the time taken to weaken it.

vii

About the intensity of the sun's rays

from

cand. mag. Absalon Larsen.

W

If the intensity of the sun's rays outside the At

atmosphere, the intensity of the rays reaching the surface depends only on the altitude of the sun and the state of the atmosphere.

As early as 1760, BOUGUER established the theorem that the sun's rays are weakened according to a geometric progression when the mass of air through which they radiate increases according to an arithmetic progression. be e.g. B. the intensity of the rays outside the atmosphere I and the intensity of that part of the same which reaches the earth's surface at normal incidence a I, then according to Bouguer the radiation intensity at the earth's surface can generally be set equal to a", where n denotes the air mass penetrated, the air mass at vertical incidence taken as a unit.

In 1838 POUILLET published his work on the radiation of the sun. With the help of the pyrheliometer he determined the intensity of radiation at different heights of the sun and, using Bouguer's formula, came to the conclusion that the amount of heat which falls at

right incidence of an absolutely black area of 1 square centimeter in size, is supplied by the sun's rays outside the atmosphere in 1 minute, the so-called solar constant, is 1.76 gram calories, and that the transmission coefficient a is the same.

During the years 1874-79 VIOLLE undertook numerous experiments on solar radiation with an improved apparatus, the actinometer, the heat-sensitive part of which was a blackened thermometer bulb. It was surrounded by a double-walled sphere to protect it from air currents and to enable greater regularity in the radiation, and water flowed through the cavity between the two spherical shells. An opening on one side allowed the rays to reach the thermometer. Violle gives the value of 2.54 calories for the solar constant.

In his great work 1), LANGLEY draws attention to the fact that Bouguer's formula is only valid for the individual types of radiation, and that if it is applied to the total radiation, the sun's constant must always turn out to be too small.

Langley's work on the sun's rays must still be regarded as the most important in this field. With a rock salt prism and concave mirror or in other cases with a Rowland grating, he divided the rays into their individual components and, with his bolometer invented for this purpose, measured the heat effect of the various types of rays from rays with a wavelength of 0.35 (ultraviolet) to rays with a wavelength of luo (ultrared), and later further into the ultra-red to rays of wavelength 34.0, the existence of which was first reported by Langley

1) Researches on the solar heat and its absorption by the earth's atmosphere

sphere. A report of the Mount Whitney expedition. Washington 1884.

was assigned. By comparing the energy spectra of the sun's rays obtained in this way at different heights of the sun, it was found that the transmittance coefficient varies very greatly with wavelength, so that the violet rays are weakened the most and the red least the least when passing through the atmosphere. The following table summarizes the permeability coefficients found by Langley at Alleghany in 1880–81:

Wavelength: 0.375 04.400 01.450 OM,300 04.600 0.700 0.800 0.4.900 14.000

Permeability coefficient: 0.39 0.42 0.48 0.54

0.61 0.71 0.76 0.79 0.80

From this table z. For example, it appears that of certain ultraviolet rays only 39 percent reach the earth at normal incidence, while about 70 percent of the red rays reach the earth under the same circumstances, and about 80 percent of certain ultra-red rays.

After arriving at these important results, Langley undertook a scientific expedition to Mount Whitney, a mountain in the Sierra Nevada, where he was assisted by numerous associates, partly at the foot of the mountain 3700 feet above sea level, partly at a high peak, 11600 Feet above the sea, in the months of August and September 1881 collected a rich observation material, which he worked on after his return to Allegany and completed by additional experiments.

Of the trek from the station at the foot of Mount Leon Pine to the summit, Langley writes that even without the use of any instruments, the change in light was readily noticeable. The color of the sky appeared far more dark blue and purple. And the skin of the face and hands was severely attacked by the rays, though-

the air was cold, and the skin had long been on the

low station exposed to the scorching rays of the sun

was.')

Some numerical values should be given from the test results

reported in the following table according to Langley. the

wavelength

0.0

16.3

10.0

15.7

5.4

12.

12.4

68.3

04.350

0.375

0.40)

0.450

0.300

0.600

88.3

160.0

0.700

162.5

25.1

28.4

50.1

29.6

110.6

153-9 129.3

201.0 177-1

191.1

180.-

155.3 151.;

100.2 94.6

76.4 58.5

44.4

32.7

22.9

14.7

10

7.9

2.3

39.9

14.8

4.0 43.8

23.2 20.3

71.5

42.1

35-3

71.1 174.2

162.5 : 149.3

118.5

117.6 229.0 214.4 203.2

160th-249th;

240.4 | 228th, 183,

214. 218.3 204.6 176.

134 3 1594 165-3 157.9 136.9

82.1

100.4

94.71

81

51.4 72.

69.1

49.1

38th, 56.1 50.5

43.8 32.7

42.7

33.1

24.1

30.8 27-5

17.2

12.9

18.-

II.4

90

6.6

2.2 3.8 3.6

3.2

0.9)

1,000

1,200

1,400

1,600

1,800

2,000

100.4

60.0

58

42.5

29.6

18.9

2,200

6.9

Columns give the heat effect of the different rays

genera, ie the energy distribution in the spectrum. the

different columns correspond to the different outer ones

I) Compare with this the experiments of Prof. Finsen on the effect

of the ultraviolet rays. This booklet page 8.

Circumstances, the height above the sea and the distance covered by the rays through the air, which is given as the air mass. It means e.g. B. "Air mass 717" that the air column penetrated by a beam of rays has the weight of a mercury column of the same thickness and 717 mm in length.

First, let's look at the numbers in the first and third columns. The former indicate the intensity of the rays after passing through an air mass 717, which at the barometric level 662 corresponds to a high altitude of the sun. The latter show the intensity of the rays after passing through three times the air mass, ie at a low altitude of the sun.

All the rays have been weakened by the increased mass of air, but in very different degrees. The ultraviolet rays of wavelength ou.35 have been completely absorbed. The violet rays of wavelength 04.375 have been reduced from 28.4 to 4.0 dh down to about 1, the blue rays of wavelength ou.40 down to ", and the red rays of wavelength ou.7 down to 4. The figures of the last four columns relating to the observations at the summit show a very similar behavior The ultraviolet and violet rays have been attenuated the most, the red and ultra-red least, but the decrease in intensity is smaller for the same increase in air mass summit than at the foot of the mountain.This shows that a given mass of air in the upper part of the atmosphere exerts less absorption than an equal mass of air in the lower part of the atmosphere.This difference is considerable, especially for rays of short wavelength.

According to what has been said, the sunlight is not only weakened as a whole by the absorption of the atmosphere, but its composition is also changed. Langley compares the Sun seen through the atmosphere to through

electric light seen through a red-yellow glass. Someone who had seen only such light in his whole life would call it white light. But if, after removing the glass, the electric light shone in its full splendor, it would appear blue to it, like the sun to us, if we could look at it from a point outside the atmosphere.

The higher the sun is in the sky and the higher one rises above sea level, the more strongly the blue and violet rays of the sun will appear, other things being equal.

Langley's investigations were carried out under the most favorable possible atmospheric conditions. The air was perfectly clear, the sky unclouded. Only exceptionally would you find equally clear days here. Langley calculates the sun's constant from his experiments and arrives at an even greater value than Violle, namely 3 Cal.

In Europe, CROVA ') in Montpellier has been investigating solar radiation for several years. His curves, recorded with a self-recording apparatus, are of particular interest, since they represent in a very clear manner the solar radiation which actually reaches the surface of the earth at any time of the day and on any day of the year. The heat-sensitive part of the apparatus consists of a thermocouple, one soldering point of which lies in the shade, while the other is exposed to the rays and is always directed towards the sun by means of a heliostat.

In figs. 1 and 2 are two cures taken by Crova at the same time in Montpellier and on the mountain of Mont Ventoux

1) Mémoires de l'Académie de Montpellier. 10. 1884.

Annales de Chimie et de Physique. (6) 14. 1888 and 21. 1890.

ven reproduced. The two curves show a depression at noon and as can be seen the noon ordinate bisects the curves asymmetrically. This is probably due to the changing water vapor content of the atmosphere. The many quite considerable rapid fluctuations in solar radiation intensity are more pronounced at the low station than at the mountain. The weather was perfectly clear in both places. Crova therefore believes that these fluctuations are due to movements of water vapor in the atmosphere. They are more prominent in summer and on warm, calm days than in winter and on days with fresh winds.

In Kyiv (Russia) SAVELIEF received very similar curves.')

Recently K. ÅNGSTROM has made absolute measurements of solar radiation with new apparatus 2). No information has yet been given about the results.

While in the foregoing only those investigations have been mentioned which relate to the heat effect of the sun's rays, there is still a series of works on the chemical effects of the rays.

BUNSEN and ROSCOE used a hydrochloric acid photometer. A mixture of equal parts by volume of chlorine and hydrogen was placed above water in a glass vessel. Hydrogen chloride was formed as a result of the action of the sun's rays

, which was absorbed by the water. This resulted in a reduction in the volume of gas, which could be read on a narrow tube. The reduction in gas volume was taken as a measure of the chemical energy given off by the jets. The results of the Bunsen and Roscoe measurements and a detailed description

1) Comptes ren. de l'Acad. of science. CX, pag. 235. 1890. 2) Annals of Physics and Chemistry 67 pag. 633. 1899.

The method and conclusions can be found in the "Annalen der Physik und Chemie"!) The unit of chemical intensity was taken from a carbon monoxide lamp described in detail. The carbon monoxide flowed under very low pressure through a 7 mm wide circular opening into the Air out With a gas consumption of 5 cc per second, the exposure at a distance of 1 light unit was called.

10000 light units give i degree of light. From experiments carried out in Heidelberg on August 3, 1857 and September 14 and 15, 1858, Bunsen calculated the following formula

0.4758pts

sinh W 318.3 x 10 where W is the chemical intensity of the direct rays of the sun in degrees of light, P is the barometric reading in meters and h is the height of the sun. From this formula you can calculate the following table for the intensity at different barometer readings and different heights of the sun.

750mm

2.5

0.0

600mm

139.8 138.2 132nd, 123.2 108th, 88.1 61.5 28.8

165.0 163.3 158.1 149.0 135.0 114.5: 85.5 46.6

7.2

194th 193.0 188.0 180th, 167.2 147.5 118.6 75.3 18.6

0.0

450mm

0.0

With a barometric reading of 750 mm and a sun elevation of 90°, ie vertical incidence, one finds e.g. B. a chemical intensity of 139.8. At the sun's altitude of 30', where the rays of light have to travel twice as far through the air, the intensity is only 61.5. The quotient 61.5 139.8 = 0.44 then gives the permeability coefficient of a layer of air weighing the weight of a mercury column of 750 mm. This agrees with Langley's statement about violet rays,

1) Annals of Physics and Chemistry 108 pp. 191-273. 1859

0

according to which of the rays of wavelength ou, 40 penetrate through the atmosphere at perpendicular incidence 42°.

Later ROSCOE made further experiments on the chemical intensity of the sun's rays. The results, as far as the direct rays of the sun are concerned, agree on the whole with those already mentioned. But his method is quite different and is based on the action of rays on photographic paper.')

The blackening of the paper is compared directly or indirectly with suitable standard colors. The method received a further development through the construction of a self-registering apparatus. 2)

Recently, WIESNER 3) has also worked with photographic paper. In particular, the latter, through daily measurements, collected a great deal of material for determining the chemical power of the scattered daylight.

For the application of the direct rays of the sun in light therapy, it is of practical importance to know both the heat effect and the chemical effect of the rays at any time of the day and year. This can initially only be calculated from the results obtained so far, provided the weather is perfectly clear, by further assuming that the air pressure is constantly equal to 760 mm and that the water vapor content of the atmosphere is the same as in the experiments mentioned. Under these assumptions the following two tables on the thermal effect and the chemical effect of the direct rays of the sun in Copenhagen have been calculated, the former from Langley's experiments, the latter from Bunsen's formula.

1) Annalen der Physik und Chemie Vol. 117 p. 529, 1862, and Vol. 128 p. 291.

2) Annals of Physics and Chemistry Vol. 151 p. 268, 1874.

3) WIESNER: "Investigations into the photochemical climate of Vienna, Cairo and Buitenzorg (Java)." Vienna 1896.

The chemical effect of the direct rays of the sun in Kopenhagen.

These two tables are not directly comparable, but the course of the numbers is. First, let's take a look at the data in the tables for June. The warming effect is 74 at noon and has only dropped to about half at 7 o'clock. The chemical effect, on the other hand, which is 118.8 at noon, has already fallen below half by 5 p.m. and is only 5.3 at 7 p.m., that is '20 of the amount at noon. The same difference in change is also noticeable in the two columns for noon in the different months. From this it follows that for purposes involving the use of the chemical power of the sun's rays without too much heat effect, only the midday hours and the summer months are favourable. It would certainly be possible to increase the chemical effect by greater concentration even when the sun was low, but at the same time the heat effect would reach too great a value.

In addition, there is the cloud cover, which was not taken into account above, which excludes regular use of the direct rays of the sun even during the summer months. In order to get an overview of how many hours per day the sun shines on average in Copenhagen, the following table on the next page was calculated from a corresponding graphic representation in the monthly reports of the Danish Meteorological Institute.

In winter, the sun is uncovered for only a small fraction of the daylight hours. In summer it shines on average during the entire daylight hours. In both winter and summer there are days when the sun shines almost continuously from sunrise to sunset. As a rule, however, it only shows up temporarily (for 1 or an hour), alternating with more or less long shadow periods.

It now appears that Denmark leaves a lot to be desired with regard to the use of the chemical effect of the direct rays of the sun. With us, as in general in northern and central Europe, preference will therefore be given to the electric arc light in this respect.

viii

Some cases of

Cases of alopecia areata with concentrated chemical light rays

treated.

Preliminary Notice

VOD

0.Jersild. First assistant at the "Vestre Hospital" and the dermatological department of the polyclinic.

This treatise is concurrent in Annales de Dermatologie No. 1, 1899

released.

A"

n one in the medical society of Dr. FORCH

HAMMER's demonstration of 50 lupus patients treated at Finsen's Medical Light Institute, a large number of results from this new therapy were presented to the Copenhagen medical world for the first time and, let it be said, the results exceeded even the wildest expectations. The 50 lupus patients, among whom there were many old ulcerative cases, all presented with beautiful white cicatrices, often barely visible, and even the most careful examination revealed no nodules or infiltrations in the skin. The area of Finsen's invention can be still hardly determine; meanwhile, so much is certain that a method here Finsens Medical Light Institute.

8th

is indicated, which opens up wide therapeutic, especially dermatotherapeutic, future prospects.

There is no doubt what the investigations of FINSEN) and his co-workers 2) have proved, that the chemical rays of light in concentrated form are among the most effective bactericidal agents known to us, and that the action penetrates deep into the tissue without change it or cause harmful side effects. A more ideal treatment of parasitic skin diseases can hardly be imagined. The requirements that must be made of the light are, firstly, that it is strong enough, secondly, that heat rays are excluded as far as possible, and finally that it is applied long enough.

A condition particularly amenable to treatment of this type is alopecia areata. As is well known, the dispute about the etiology of this affection is old, but as far as one can judge, even earlier anticontagionists in Germany seem to adhere to the long defended theory of infection of the French dermatological school. In this connection it is interesting that Lesser, in his last edition of the Textbook of Skin Diseases, in contrast to his earlier conception of the disease as a wholly nervous affection, now recognizes two forms: the trophoneurotic and the parasitic. It is strange that the concession should be so slow, especially considering the convincing and epoch-making work that has been delivered from France (Sabouraud et al.) on the question of etiology in recent years.

1) FINSEN: About the application in medicine of concentrated che

mix light rays. Leipzig 1899. 2) See Bies and LARSENS article.

I am not blind to the fact that one must have as large a body of material as possible in order to draw conclusions as to therapeutic outcomes, particularly where it is a condition which - like alopecia areata - tends towards spontaneous recovery, certainly often at first , after having existed for years. As the disease is very rare in this country, we have thought it best to call attention now to this treatment, which I hope will prove rational; several years might otherwise elapse before sufficient material would be available.

I collected my cases in the Department of Skin Diseases Polyclinic; some of these have been sent by private doctors. All patients have been treated at Finsen's Medical Light Institute.

I would like to express my sincere thanks to Professor FINSEN for his kind courtesy and for permission to publish the cases, and to my boss at the polyclinic, Dr. medical LUDWIG NIELSEN, thanks for letting the patients.

It is never a good sign when the number of treatments and remedies proposed for an ailment is great. As to alopecia areata, a disease the treatment of which has particularly occupied the attention of physicians, one need only consult the major manuals to see that the results scarcely corresponded to the ingenuity and toil employed. This is also acknowledged by most dermatologists, who regard therapy as completely powerless against the disease mentioned here and place their hope in time and their spontaneous recovery. To only one

To cite a few examples, KAPOSI says: 1) “La thérapeutique manque, à l'égard de cette maladie, de toute base positive et, en tant que empirique, de toute certitude; elle ne peut ni en abréger la durée, ni empêcher qu'elle éclate sur un nouveau point. Le temps du reste agit évidemment pluset mieux que tout ce que l'on peut faire," and LESSER 2) claims that there is no remedy that can stop the hair from falling off or promote new hair growth and suggests " ut aliquid fiat" proposes the means commonly used. All the various French methods (VIDAL, BESNIERS treatment, etc.) have two main moments in common, namely 1. the local application of irritantia and 2. the general prophylactic antiseptic of the scalp. SABOURAUD 3) the, as is known, has detected a possibly specific form of bacteria (microbacille de l'utricule peladique) in alopecia areata, assumes that the toxin effect of this bacterium on the papilla is to blame for the hair falling off.In his opinion, the use of local irritants should be rational by facilitating the elimination of stagnant, harmful metabolites, while antiseptics should be on the spot en themselves be ineffective by not penetrating into the depths.

If we seek clarifications on the results of these treatments recommended from France, we find fol. near BROCQ:-) Le traitement de M. le Dr. E. Vidal nous a semblé thunder of the results fort rapides: il peut guérir une pelade caractérisée par des plaques de moyenne grandeur en trois à six mois; il en est à peu près de même de celui de M. le Dr. E.BESNIER.

1) M. KAPOSI: Pathologie et traitement des maladies de la peau. traduct.

par E. Besnier et A. Doyon. 2 edit. II. Paris 1891, pp. 194-196. 2) LESSER: Textbook of skin and venereal diseases I. Leipzig 1896. 3) SABOURAUD; Studies clinical and experimental on the origins of la

pelade. ann. de dermatologie 1896. 4) Broco: Traitement des maladies de la peau. Paris 1832.

So the fastest French methods take at least 3-6 months.

Before proceeding to give a summary of the case reports, I think it most appropriate to emphasize the qualities of light, after which the treatment of what I consider to be a parasitic condition, "pelade vulgaire", i.e. the infectious, sometimes epidemic form of alopecia areata based and to give a brief description of the method which has been used here.

The moments in the effect of light, which initially become of decisive importance, are:

1. The bactericidal depth effect of light.
2. The hair growth stimulating effect of light.
3. Causing local skin inflammation by

the light.

1. The bactericidal effect of light has been proven by numerous investigations (DOWNES and BLUNT, DUCLAUX, ARLOING, GEISLER, BUCHNER, D'ARSONVAL and CHARRIN); the bactericidal depth action is proved by FINSENS experimental investigations, ') as well as by the tangible results of lupus treatment.

2. As far as I know, there are only a few studies by an author in the literature about the influence of light on the growth 2) of nails and hair, according to which light should promote hair growth. some popular ones

1) FINSEN: 1. c. P. 29. Herein bibliographies. 2) BERTOLD: MÜLLERS Arch. for anatomy and physiology. 1850, p. 156.

Observations, which I recall in passing without attaching much importance to, seem to be moving in the same direction. It is an old, well-known folk observation that shaving and hair-cutting are more often necessary in summer than in winter; furthermore, it is well known that it is much easier to grow a full beard in the southern zones than in our northern climate. There are, however, real clinical observations in this respect; it is Z. B. A fact, which I can corroborate with a few extracts from journals, that one often sees more copious hair growth in the extent of the light-treated lupus affections than in the other parts of the skin.

Medical report IKR 21 years old, unmarried woman. lupus erythema. Treatment began at 96.

The 1697 is noted: The spot on the right cheek is surrounded by a tangle of strong hair; these only developed about 1 month ago when the patch had healed

, The patch has only been treated with electric light for 4 hours the first days of September.

Medical report II. ER 9 years old, daughter of a pilot. lupus vulgaris. Treatment started 10, 96.

The 15, 97 is noted: The growth of hair (the lanugo hair) outside the cicatrice on the healthy skin is more luxuriant than on the rest of the skin.

Den 144 97. There is some pigmentation of the sound skin around the patch formerly attacked, and a profuse growth of lanugo hair.

Den 4 97. The growth of hair is heavier around the edge of the cicatrice, especially downwards and backwards, than on the rest of the cheek.

These observations are compared with the testimonies of the nurses working at the Light Clinic, according to which their arms, exposed to the strong electric light, seem to grow more hair than before

was.

9

24

to support the notion that light has hair growth stimulating properties.

3. There is no doubt that the vigorous use of irritants, and the hyperemia of the skin thereby produced, 1) are largely to blame for the results which the French authors think they have obtained from their treatments. In the light treatment of alopecia areata, local dermatitis is certainly also a factor of a certain importance, because the fact that reddening and subsequent desquamation of the skin, in higher degrees even bulla formation, can be caused by the action of the light rays is observed daily at the institute it must be emphasized that the local reaction has in about all cases been kept within the limits of the very slightest inflammation of the skin, and consequently it can hardly be supposed to have played any essential part in the results obtained.

All cases have been treated with electric light (arc lamps of 50-80 amps). Whether the sunlight might have a stronger effect I cannot say; a priori I am inclined to accept it by analogy with the results in the treatment of lupus.

The apparatuses are known from FINSENS earlier communications, to which I refer;2) I only add that all cases of alopecia have been treated with the latest apparatus with rock-crystal lenses.

1) It is quite interesting that the latest French treatment of

Alopecia areata (JACQUET: Traitem. de la pelade par l'irritation aseptique simple. Ref. i Sem, med. 1898 No. 26) aims to produce the desired skin hyperemia mechanically (brushing the spot and its surroundings).

Incidentally, see SABOURAUD's earlier quoted interpretation of the effect of local irritantia. 2) FINS: 1. c.

Of the treatment of the stain itself I will give a brief description. In order to be able to influence the actual growth zone directly and unhindered, we shaved around 192 cm in circumference around the spot; Epilation is not applied. The whole patch and the shaved area were then illuminated in daily séances of usually 5% hours. In the case of larger stains we have occasionally had 2 séances in one day. When the whole spot has been illuminated (the time taken to do this is of course proportional to the size of the spot) the treatment stops and another spot is treated on top of it. Once all affected parts have been examined, the patient is discharged with a request to come for observation.

To prevent the disease from spreading, the healthy parts of the scalp have been treated with daily soap and sublimate washes; infected hats have of course been confiscated, and orders have been given to disinfect combs, hairbrushes and the like, and the use of sponges in washing dishes, which is done with tampons of hygroscopic cotton, has been forbidden; these are discarded after use.

FINSEN has shown that it is an important condition for the depth effect of the chemical light rays that the affected part is emptied of blood as much as possible, and for this purpose, as is known, pressure glasses are used at the light institute. In the cases of alopecia areata treated first, compression was also used on the patch, but in those treated later it was not necessary to bleed the skin, probably because the bacteria in alopecia have their place in far more upper areas

flat layers than the tubercle bacilli have in lupus skin diseases.

Since it is impossible to exclude the heat rays completely, it is necessary to cool down the illuminated areas of the skin. The used pressure apparatus consists of two rock crystal plates set in a metal ring, between which cold water is fed. When the pressure apparatus is not used, the skin can be cooled by occasionally wetting it with cold water.

The treatment is completely painless if done in the right way.

medical reports.

I. Philipp H. 15 years. A tailor's son. beginning

den 3, 97 History: No information about infection. the

Illness was noticed at the beginning of June, it was then a

bald patch, 1 cm in diameter, which has always grown. Status praes: A completely bald spot 6X4 cm between

the ear and the midline of the head. The lowest edge of the patch a couple of cm below a line corresponding to the top edge of the ear. Kolbig Ver

thickening of hair. Treatment started: 9.97 Treatment stopped: 24.97 after 8 séances of 12 hours.

)

0 97. Fine lanugo hairs on the patch.

5% 97. Normal hair growth, no bulbous thickening of the

Hair.

12, 98. Rec. in loco. A lot 2'2X2 cm

where none

Hair is left, tapering downwards.

Treatment resumes at 12.98.

Treatment ceased in 164 after 5 séances of 1 hour each.

I

29

II.

22, 98. Fine little hairs on the mentioned triangle.

/3 98. There are no hairs on the scar 1), otherwise there is

the growth of hair just as strong as on the other parts

Of the head. 11, 98. Always a bare post-burn scar. by the way

a completely thick growth of hair; no loose hair. 21/10 98. Always unchanged. Thick hair of normal color. Observation time approximately 9 months after the interruption

of treatment Mette N. 52 years old, married to a tailor. beginning

den 24, 98. Anamnesis: No information about infection. The suffering

started just before Christmas with a patch above the left ear. The stain kept growing. Man applied only soap washes (naphtol). Status praes: A patch 8x5 cm above the left ear, almost completely hairless. 2. A patch 3x3 cm

above the right ear.

3. A patch 2x2 cm on the crown. Treatment began: 241 98. Treatment stopped the 142 98 after 29 séances à

I hour up, in the 29 séances one has spots 2 and spots 3, as well

also treated the front edge of patch I.

Not a strong reaction, just some redness. 1 98. The patient has not yet attended.

Spots 2:

recovered. Spots 3: also.

I) Outward and inward appeared after treatment of the shaved area

a bulla 2 cm in diameter. She left a scab that shed in September. The spot where he had been sitting was red and scar-like.

Spots 1: the front part with rather thick,

covered with fine, gray hair, no

hair falling off

In the part to the back (not

lights up) the spot is right

significantly common.

Treatment started again: 7 98 of that

posterior parts of patch 1 + wider spread. Treatment stopped: 19%, 98 after 14 séances.

98. Abundant, normal hair growth with fixed hairs all over the patches. The growth of hair on the spots very streaked with grey, while the rest

hair is all black in colour. Observation time after the interruption of the Be

treatment, about 8 months for the first treated lots, and about 3 months for the last treated

dirty stains. III. Helge H. 15 years. The son of an ironmonger. beginning

the 11, 98. Anamnesis: books brought to an office clerk who the

said to have had the same illness. Started patches 1 and 2 3 months ago. Spots I particularly like

significantly grown. Been treated with alcohol. Status praes: 1. A spot 5x3 cm a little to the left and in front of the vertebra.

2: A patch 3X2 cm: just to the right of the whorl. Loose hair in the circumference, slightly ge curved edges. Treatment started: 11/2 98. Treatment stopped: 222 98 after 1 séance.

98. The condition seems relieved, as the hairs are natural along the edges of the patches, and there is profuse formation of hairs throughout.

Healthy, increasing hair growth on the old patches. There are 3 new patches:

3. A patch 1'2 cm in diameter

round, above the left ear. 4. A patch 1'2 cm in diameter ge

rade in the vertex next to the old spot 2. 5. A spot irregularly shaped, right

from the vortex. Treatment restarted: 45 98. Treatment stopped: 2115 98 after 38 séances. 13/6 98. Spots 1-5 (ie all spots) are hairy

overgrown. No sick hairs in the fringes, none

shed. 21/10 98. No sign of illness. Hair growth and

hair color normal. Obversation time after stopping treatment

As for the first spots 8 months, as for the

the latter about 5 months, IV. Agnes K. 9 years. A coachman's daughter. 2874 98 began. History: The illness began 8 weeks ago. Always

treated at the polyclinic, but has the disease

always spread. Status before:

1. Round patch, 6 cm in diameter

at the nape to the left of the midline. 2. Round spot + cm in the middle of the nape

in the hairline. 3. Oval patch 3x112 cm on the crown

above the right ear. 4. Round spot 2 cm in diameter, approx

about 4 cm below and behind of 3. The spots are completely hairless, smooth, white. The hairs on the edges are loose, bulging thickening

of hair in several places at the edge. Treatment started: 284 98. Treatment interrupted: 2115 98 because of a

femoral lesion.

8th

Treatment resumed: 66 98.

Treatment stopped: 13.98 after 48 séances throughout.

6th 98th

All spots are healthy with increasing hair growth. 26. 98. Same. 2110 98. Completely normal hair growth; no trace of the disease, observation time after the interruption of the Be

action 4 months. V. Johannes S. 23 years. stud. mag. Start the 16% 98.

History: The bald patch was discovered 14 days ago.

Treated with Besnier's liquid (chloral, glacial acetic acid and ether).

Status praes: A spot 2x3 cm, a few cm to the left of

tubes occip. Loose hairs at the edges.

Treatment started: 16'5 98.

Treatment stopped: 18 after 3 séances.

's

26's 98. The patch unchanged as to size,

something red. At a single point medial and downward

a little more redness and flaking. Separate loose hair but no bulbous thickening.

Lively, fine hair growth.

Treatment resumed 177, 98.

Treatment stopped: 22, 98 after 5 séances.

98. Abundant hair growth. The hair color lighter than that

environments. On the earlier mentioned part inside

and downwards, the hair growth is always a little thinner. By the way, no suspicious characters. 26 11 98. Good hair growth overall. The hair again

little brighter. On a lot about the size

a pea inward and downward, hair growth is thinner. Observation time after the interruption of the Be

action about 2 months. VI. Erwin G. 83 years. The son of a baker's journeyman. The

10 98 started.

21

10

4

10

I

Anamnesis: The suffering lasts a couple of months

Lasted a few months, no treatment. Status praes: 1. Elongated, irregularly shaped spot,

4X2 cm in the left parting region, 5 cm

above and a little behind the ear. 2. Round patch cm in diameter

in the right crown region, about 10

cm above the ear. 3. 6 small spots on the back of the neck, approx

5 cm above the hair line, and í narrow spot in the middle of the head

with thinning hair growth.

Flabby thickening of the hair at the edges,
Treatment started: 1%0 98.
Treatment stopped: 24 98 after 13 séances.
310 98 Loose hair nowhere to be found.
W 98. No new spots. Most of the small spots

quite well haired, but still visible. The patch above
the left ear has not grown; few hairs here

and since on it, these are natural. No loose fitting

Hair. 21/1 98. Most small spots barely visible; the

whole bald patches with increasing hair growth. No loose hair.

Observation time after the interruption of the Be

action: about 1 month. VII. Holger V.-S. 50 years cigar dealer.

50 years cigar dealer. Started the 911 98. Medical history: He believes from an acquaintance who has a pelade

decalv, had to be infected. The current patch is

always grown slowly during 2–3 months. Status praes: Round spot with a diameter of 3 cm in

the left temple. Loose hair at the edge. No bulbous thickening of the hair.

26/

Treatment started: % 98.

Treatment stopped: 12%, 98 after 4 séances.

18% 98. Distinct downy hairs all over the patch.

u 98. Lively growth of hair throughout the patch. the

Hair is still unpigmented. The stain has gone

not enlarged. No loose hair. 2012 98. On all the patch that hasn't grown,

good hair growth. No loose hair. The hair always

unpigmented. Observation time after the interruption of the Be

action: 5 weeks.

I shall make as brief as possible the remarks which I would like to make in connection with the case reports mentioned above.

Turning immediately to what I consider to be the most convincing and illustrative case, I will highlight Case Report II. The disease, which is only about 1 month old, is nevertheless quite widespread, and is, moreover, stated to be in continuous propagation. When the patient, who has been away from the light clinic for about 4''2 months, is called for an examination, the light-treated areas (spot 2, spot 3 and the foremost edge of spot I) have healed, while the untreated rearmost part of spot i itself has widened. This seems to prove that the affliction, despite its undeniable propensity to be propagated, has been brought to a standstill and cured directly by the treatment, and a further conviction - I may almost say of the specific effect of the light treatment - is gained by that the propagating part of the condition that is left is also responsive to treatment. The long intervals between revisions - due to the unreliability on the part of the patient - prevent an inspection of how quickly the recovery occurred in this case, but all the more emphasize the contrast between treatment and non-treatment.

In the Instructional Report III, it strikes me as more convincing that the new spots (3, 4, and 5) are overgrown with hair 17 days after stopping treatment than that the original affliction (spots I and 2) was 13 days, after the treatment is completed, lifted, and barely 3 weeks after the patient presented himself at the light clinic. Because the cessation of the original illness, which was already three months old, could be necessary, even if somewhat forced

be explained as a consequence of the spontaneous recovery to which alopecia areata is apt, while this cannot rightly be supposed in regard to the infection which has arisen later.

On the whole, it is an unexpectedly quick reaction, which all cases show in regard to hair growth. In the case report I we see lanugo hair ni days after stopping the treatment (ie 1 month after starting the course) and normal hair growth after about 2 months. The small in loco recurrence mentioned in this case report was covered with fine hairs 10 days after it was diagnosed and treated.

The longest period of convalescence (2 months) is found in the case report IV. Here the affection is very widespread and always propagating; in addition, a 16-day interruption in treatment due to a femoral lesion must be noted.

The shortest response time is in Medical Report VII, where downy hairs are present on the patch 6 days after the completion of the treatment and 10 days after the start of the regimen.

The bulbous thickening of the hairs mentioned by Sabouraud, the presence of which shows that the disease is spreading, were present in three of the cases; loose hairs in the margins are noted in 4 of the case reports. In 5 of the anamneses it is stated that the patients themselves noticed the persistent growth of the spots.

Recurrence in loco is only found in one case (case report I). The spots that appeared in other places on the head in medical report III cannot be attributed to the light treatment, at most the general antiseptic treatment of the scalp.

The longest observation period for recurrence after stopping treatment is 8-9 months. (The case reports I, II and III).

The only instance of an accident occurring during treatment is in Medical Report I, where a minor burn leaves permanent baldness. In all other cases the local reaction has not exceeded the limits of the desired superficial dermatitis. As with the other treatments and with spontaneous recovery from the condition, the first hairs are fine unpigmented lanugo hairs. The pigment deficiency may persist even after the hair is of the normal shape (e.g., on medical record V). The hairs in Medical Report II have undergone a very peculiar change, where their color is grey, even after they are exactly the same in length and thickness as the rest of the black hairs. The explanation can only be sought in the age of the patient (52 years). Finsens Medical Light Institute.

The disease certainly affected the hair papillae in such a way that the regenerated hairs reached the venerable color ahead of time, which the onset of senility gives to the other hairs a little later.

How the treatment affects the very spread forms (Pelade dècalvante) I cannot comment on. I hope that these forms, which certainly arise from growth and confluence of the scattered spots, can be avoided by early treatment of the individual propagating alopecia.

Printed by August Pries in Leipzig.

foreword.

In this booklet the second and third booklets of the Danish edition are collected; two articles have been left out because they have already been published elsewhere, namely Professor FINSENs: Das Licht als Incitement (On the Significance of the Chemical Rays of Light for Medicine and Biology. Three papers by NR FINSEN, Leipzig 1899) and Professor H. MYGINDS: Lupus vulgaris laryngis, a clinical investigation (Archive for Laryngology Vol. 10).

Dr. Th. SCHÜLER in Berlin has shown us the kindness to correct the translation of this issue as well as the previous one.

Copenhagen in December 1900.

Valdemar Bie.

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I

The Effects of Light on

microorganisms

from

Sophia Bang.

1) A new research method.

despite the numerous works of recent years on the

Effects of light on bacteria, the more than twenty years of work by DOWNES and BLUNT on this subject still holds the leading position. On the whole their results have been confirmed; moreover, we have been enriched with a great deal of detailed knowledge, but few later researchers have succeeded in drawing up new guiding points of view, and the opinions of the individual authors differ so widely that a study of the relevant literature gives an impression bordering on the chaotic. This leading position

of the works of DOWNES and BLUNTS deserve all the more emphasis because the great distance between them and most of their successors is usually not sufficiently emphasized. Certain imperfections must stick to experiments on hitherto unknown ground, but they made no other mistakes than their successors.

You have to be amazed at how versatile DOWNES and BLUNT were able to take things right from the start. Not only did they discover that both diffuse daylight and direct sunlight can inhibit all kinds of bacteria, both spores and vegetative forms, or kill them over longer periods of time or at greater intensity. They also proved that this effect is due mainly to the most refractory rays, and they demonstrated through control experiments that it is not the heat of the sun that matters, but its light, and that the effect takes place both when the bacteria are moist, as if they have dried up, although the medium surrounding the bacteria affects the time required for the light to take effect. They also showed that the presence of oxygen is necessary, and even that the effect of light is to some extent proportional to the oxygen tension. They saw the possibility that the light effect could consist in a modification of the culture medium, but they found that this was not the case, at least in their experiments. They even thought of the possibility that the light could act on the metabolic products of the microbes, finding that a cell-free yeast infusion loses its ability to transform cane sugar into glucose and that this light effect also occurs the presence of free oxygen is linked.

All these results have been increasingly confirmed by later investigations. Only a few new things of fundamental importance later appeared. In this way, MARSHALL WARD demonstrated the great importance of ultraviolet rays. Roux has demonstrated that, after sufficiently long exposure, bouillon can become a less favorable soil for the germination of anthrax spores. Yes have

Subsequent investigations proved that this effect, although not without theoretical interest, is practically of secondary importance in comparison with the direct killing effect on the bacteria themselves, since it only clearly occurs under very long and intense illumination. However, it is not yet possible to pronounce on this point with complete certainty, because really quantitative determinations are still missing. - So far it is just as uncertain whether RICHARDSON and DIEUDONNÉ rightly assume that the effect of light is based on the formation of hydrogen peroxide. ARLOING'S attempt to depict vaccines by means of bacteria weakened by light must also be mentioned as something new that arose after DOWNES and BLUNT.

Of course, the later investigators improved the experimental design insofar as they worked with pure cultures, while DOWNES and BLUNT worked with random mixtures of bacteria, decaying liquids, the air, etc. On the other hand, important as this advance is, one must not forget that this was simply a consequence of the development of bacteriology, with the first work of DOWNES and BLUNT appearing in 1877 (the first related work with a pure culture in 1885). Nor should one overestimate the importance of this progress; for that light could kill the bacteria of a pure culture might have been predicted with some degree of certainty, having previously established that it could kill all sorts of adventitious mixtures of bacteria, just as they occur in nature. That which, in principle, should have been achieved first and foremost through the use of pure cultures, namely an exact determination of the conditions under which each individual bacterial genus is killed, so that there

New biological information about bacteria has been obtained to a very limited extent, as I will explain below, mainly because insufficient attention was paid to the physical conditions.

One gets the impression that most of the work in this field is carried out by more or less good bacteriologists, but by bad physicists. There are a few, but all the more fatal mistakes that appear again and again in the various authors. In the first place, it is extremely rare to find out exactly what intensity of light was used, although it should be believed that this factor must play the same role in investigations into the action of light as the measurement of temperature in thermodynamics. Where it is a matter of examining the effect of sunlight or daylight, there is nothing to be said against it; for it is of course still important to know that "the sun" kills this or that bacterium in so and so many hours, even if we are not told how strong this sun was; but I find it unforgivable if e.g. B. DIEUDONNÉ, to name one of many, states that an electric arc light with 900 candles can kill bacteria in a certain time, but does not state at what distance from the light this takes place, or if he knows neither the strength nor the distance from the incandescent light used communicates.—It is perhaps even worse with all those authors who examine the effect of the individual colors.All (e.g. ARLOING, d'ARSONVAL & CHARRIN, BECK & SCHULTZ, BILLINGS & PEEKHAM, BOCK, DIEUDONNÉ, DOWNES & BLUNT , SERRANO FATIGATI, GAILLARD, GEISSLER, JANOWSKY, KOTLJAR, KRUSE, LAURENT, LEDOUX-LEBARD, LÜBBERT, SANTORINI, WARD), who use light filters, omit information about the attenuation of the light in the individual spectra tral areas. The most diligent researchers determine spectroscopically what types of rays pass through the filters; but how much passes through them remains unknown - and yet they make comparisons between the different spectral regions. Such investigations are equivalent to investigating whether coal or wood heats best without knowing how much is used for heating.

Nor has it been determined what percentage of the light penetrates to the bacteria. There are only very few experiments where one can only estimate, even with the best will in the world, how much light penetrated into the interior of the culture, i.e. to the place where the bacteria were. With few exceptions, the authors have sealed their cultures in glass jars. If one had at least used plane-parallel glass plates, one could in some cases calculate the amount of light that had penetrated if one took into account the angle of incidence, the reflection, and the absorption both in the glass and in the nutrient medium. But in reality, most researchers have used "test tubes", "flasks" and similar vessels that are difficult to define optically, and we are therefore only faced with unknown quantities. It is of course of great interest to know whether e.g. B. sunlight can act on bacteria enclosed in glass vessels - but more in a practical than in a biological respect, since one must realize that when using glass one excludes, among other things, a very large part of the ultraviolet rays.

The importance of this, at least from an optical-physical point of view, can be seen from the following experiments, which I carried out with LARSEN's actinometer, which will be described later. If you let electric sparks jump between two metal poles from a Ruhmkorff and then move them far enough apart for the sparks to no longer jump, you can, when the rays of an electric arc lamp fall on the negative pole, cause the sparks to start again, despite When such an apparatus was held at 30 cm. distance from an arc of 35 amperes and 50 volts, in the rays emanating downwards at an angle of 45° with the axis of the coals, the sparks could, at a certain voltage, jump straight if the metal poles were 2.55mm apart.

At 2.56 mm they no longer jumped. If a 10 mm thick quartz plate was pushed in between the arc light and the spark path, this ratio did not noticeably change. If, on the other hand, an opaque body (e.g. cardboard) was interposed, sparking only took place when the poles were approached at a distance of 0.43 mm and stopped again at 0.44 mm. If, instead of cardboard, a glass plate 0.7 mm thick (ie about half the thickness of an ordinary coverslip) was used, the poles again had to approach each other up to 0.3 mm to obtain sparking, and this latter again stopped at 0.44 mm. In other words, while 10 mm quartz does not block a measurable quantity of the actinic rays concerned, 0.07 mm glass does not transmit a measurable quantity of them. -- MARSHALL Ward proved through direct experiments that precisely this type of radiation, which goes through quartz but is absorbed by glass, has a strong bactericidal effect, namely through spectra, which were generated partly by glass prisms, partly by quartz prisms.

If you use glass containers for your cultures,

got to

one must therefore be aware that one is thereby excluding a certain part of the rays. In this context it is characteristic for me that BUCHNER, in his work on the self-purification of rivers by light, succeeded in killing the bacteria in a much shorter time than earlier researchers, e.g. B. in as little as an hour by exposing the germinated water in open containers to the sun; whether he realized what role glass played in the other experiments is not clear from his work.

In certain experimental setups, refraction plays an even greater role than the absorption of the glass. When a lot of researchers (e.g. ARLOING, JANOWSKI, KRUSE, LEDOUX-LEBARD, RASPE, TIZZANI & CANTANI, TYNDALL, MARSHALL WARD) have used a nutrient liquid in test tubes or similar glass vessels, refraction becomes of crucial importance. It is well known that the convex surface of the glass refracts the rays, so that they converge towards the middle of the liquid, while the lateral parts of the liquid come to lie in darkness; How complete this darkness can be is shown by the following experiment: Hold a test-tube filled with water close to a piece of photographic silver chloride paper and let the sun or an arc light shine on the glass. In a few moments the paper becomes blackened, partly around the glass, partly along a very narrow focal line behind the middle of the glass; on either side of this line one sees a wide stripe, where the silver paper has remained completely white; so there was no light effect here. No significant light has penetrated to the corresponding points in the interior of the liquid. You just have to be amazed

that succeeds at all, all the bacteria in the glass

it

to kill this way. Apparently it is only possible because the liquid is brought into circulation, so that each individual part comes successively into the illuminated region; but that the time necessary to sterilize the liquid is thereby made much longer than if all the parts were illuminated at once, is probably indisputable. Therefore we also see that the times given by the authors are on average much higher than mine, insofar as it is at all possible to compare the times (see the protocol of the experiment, section II). It is, of course, right, indeed necessary, to make such experiments, because they approximate certain naturally occurring or practically important relationships; but it must always be borne in mind that this investigation does not concern the speed with which a bacterium is killed by light, but the speed with which a given quantity of liquid can be sterilized under the given conditions. The fact that people were unclear about this meant that there was hopeless conflict about the times given by the individual researchers and that some researchers, such as LÜBBERT, BECK & SCHULTZ, RASPE, UFFELMANN, even received completely or partially negative results.

The experimental arrangement can be somewhat better if a solid nutrient medium enclosed in glass vessels is used; but here, too, the irregular refraction in the unpolished glass plays a role as soon as one tries to determine limits, the light thereby being distributed unevenly over the surface of the culture; in addition, the agar or gelatin and the substances mixed with them will themselves absorb the light, especially its short-wave part, and the result will therefore depend, among other unpredictable factors, on how deeply the bacteria are embedded in the nutrient medium,

.

ref, from the thickness of the agar or gelatin layer. This also applies to the otherwise very useful BUCHNER method, which aims to illuminate a plate culture from the underside (that is, from the side that is in contact with the glass) in such a way that only certain parts of the culture are illuminated, while parts directly adjacent to it are against remain protected from the light by means of opaque letters written on the glass or in a similar manner. If, under these circumstances, an exposed portion turns out to be sterile after a certain period of illumination, one can, strictly speaking, only conclude from this that even those bacteria which were most protected by the agar layer are killed by the illumination in question. When the action began on the bacteria located on the side of the agar layer facing the light remains unknown. This method can be used where it is important to compare the properties of different light sources, but it is less suitable in biological questions where the main concern is to find the minimum killing time of a certain bacterium. In earlier investigations at FINSEN's Light Institute, it was believed that BUCHNER's method was to be intensified by determining the point in time when the first visible "weakening of the bacteria" became clear, but here one was content with an unclear term. From the first visible attenuation, it was understood that the exposed spot, after all surviving bacteria had outgrown, looked a little less cloudy than the unexposed parts of the culture medium. But this will take place when the intensity of the light (or the exposure time) was just great enough to kill the bacteria in the part of the nutrient medium closest to the light source, while the light in the deeper layers of the nutrient medium was so weakened by absorption that they didn't die here. So what was demonstrated was not an attenuation of the bacteria: they just killed some and left others alive, reducing the number of colonies that grew out; in other words, no weakening but a “dilution” has been demonstrated. .

It is difficult to determine in this way whether there has also been a real weakening of the individual bacterial individuals; at any rate, no proof of this has been provided up to now. And the conclusion that can be drawn from the experiment is only the following: the light in question was just strong enough, without losing its bactericidal properties, to enter a nutrient medium of the color and transparency in question, with bacteria in the density in question seeded to penetrate a "visible" stretch, all factors that contribute to the outcome but are difficult to keep constant or to express in numbers.

If, on the whole, so little attention has been paid to such drastic sources of error as all those mentioned above, one should not be surprised that the results of the various investigators differ so much from one another; and so it is hardly even possible to compare them with each other, indeed it is sometimes difficult to understand how the individual researcher could obtain constant results within his own series of experiments, especially when there are also those deviations which I will demonstrate experimentally in the following . If the theory of the relation of bacteria to light is to take the place in biological science which it certainly deserves, given the role that this relation plays in the economy of nature, much greater weight than hitherto must be placed on quantitative work . That the first investigations in an entirely new field by and large

mainly qualitative, is not surprising and such investigations are of great importance as groundbreaking and stimulating. But gradually in this science, as in any other, one reaches a point where it becomes necessary to "weigh and measure." And the measurement must be double here; partly certain effects of light can be measured by means of microbes, partly certain properties of microbes can be measured by means of light. Both kinds of measurements must be made, but in the first place it seems to me most natural to start with light, as the best known of these factors. Light must be the precisely weighed reagent with which we seek to measure new aspects of bacterial life; but this is only possible if we take precise account of the physical conditions. An improved examination method is the condition sine qua non.

The method I used.

In order to achieve the most precise dosage of light possible, I have tried to create an experimental arrangement whereby the light beam encounters as few and as small obstacles as possible on its way from the light source to the bacterial body, and where the obstacles cannot be avoided are to be appraised and measured.

I believe that I have found a somewhat satisfactory solution to this problem in the use of the apparatus described below, using as few and as simple reflecting surfaces as possible, as little absorption and refraction as possible, constant temperature, and the possibility of the light

vary in strength in a predictable manner to can

no, has.

I shall here describe the arrangement and setting up of the apparatus, using electric light; with appropriate changes in placement, it can also be used for sunlight.

Before discussing the details, I would like to point out for guidance that the principle used is to spread the bacterial culture in as thin a layer as possible, e.g. B. as a hanging drop to spread on a thin quartz plate; this quartz plate is attached as the ceiling of a "wet chamber"; this chamber (hereafter referred to as "culture apparatus") is ge in a with water. filled box housed; this water is kept in constant flow and at constant temperature by a wheel. Light is admitted through a quartz window in the side of the box.

The light source. The electric arc lamp (see L on the figure) is suspended in the usual manner in the Finsen Light Institute, so that it can be moved up and down and to all sides and fixed in any position by means of screws. The carbon thickness is chosen empirically in such a way that the arc always keeps the same place in space as far as possible; Since this is difficult to achieve with absolute accuracy, since after a long time one coal usually becomes a little shorter than the other, causing the arc to be somewhat displaced, I have always attempted with freshly inserted coals of a certain length. In the period of a normal test series, 1 to 2 hours, the arc then does not noticeably change its place; however, if the experiments are longer, it may be necessary to raise or lower the lamp a little. In order to control the position of the arc precisely, I placed a small projection apparatus (2) on the screen (X) surrounding the lamp;

this consists of a biconvex lens and a plane mirror, by which a magnified image of the carbon tips and arc is projected onto a scale drawn on the wall of the laboratory. Any change in the position of the arc is immediately apparent in this way and can be corrected immediately. In other respects, too, it is of the greatest importance to constantly observe the arc in this way. Even if one places one carbon in line with the axis of the other as precisely as possible, it is very easy for the positive carbon's "crater" to burn crookedly, causing the light to be thrown more to one side. For experiments that are to be made one after the other and only to be compared with one another, this circumstance does not play a major role, since a crater that is not too sloping retains the same direction and shape for hours; but in order to be able to compare experiments made at longer intervals one must avoid the obliquity of the cratering, which is greatly facilitated by observing the tips of the coals from the beginning by means of the above-mentioned projection device. - In the series of experiments described below, I always used a current of 35 amps with a voltage of 50 volts. Regarding the accuracy of the regulation, I refer to the experimental protocol reproduced below. The positive carbon (the upper one) in the lamp used had a diameter of 24 mm, the negative one 15 mm.

The preparation. In front of and below the lamp is a rectangular board (FG), which is fixed at a certain angle to the axis of the coals. As is well known, the light emitted by the arch is distributed extremely unequally in space; the greatest quantity goes obliquely downwards in a belt between 45° and 55° with the axis of the coals; above and below this belt the light intensity drops very rapidly. Which angle one chooses is in itself fairly immaterial for comparative experiments; but you always have to choose exactly the same one. For the time being I have chosen 45° for external reasons, but I do not recommend this angle as the most appropriate, because a slight lack of accuracy in setting up becomes of greater importance than with e.g. B. 500, because the first-mentioned angle is too close to the point where the light intensity decreases sharply with increasing angle. If you choose a different angle, you have to consider the possibility that not only the luminous intensity, but also the relative proportions of the different color rays can change with the beam angle (by the way, I later attached the board to the lamp suspension in such a way that it all radial positions, the arc thought as the center can be attached). - Not only must the board be at the angle in question, the extension of its surface must also intersect the axis of the lower carbon so deep below the arc (in the proportions given below approx. 6.0 cm below the tip of the lower carbon) that the rays , which meet the center of the quartz window, run parallel to the surface of the board.

The tin box (ABCDE), in which the culture apparatus is to be placed, is fastened to the board by means of the brass bracket (cmk); at k it is provided with a notch, with which it is attached to one of the pins (h); these are placed on the sides of the board at such distances from the arc that the light intensity at the point inside the box where the cultures are located gets the values 1%, % 0.9% etc., depending on the pin used . The calculation of these distances is done, of course, using the law of decreasing luminous intensity inversely proportional to the square of the distance. If we take as the unit that exposure L, which is found at an arbitrary distance a from the light source, then we have

9

10

that distance, A, where the illumination is of the desired magnitude 1, in the formula:

If you take z. B., as I did below, the illumination at a distance of 280 mm as a unit, one has illumination I. at a distance of 280 mm

0.7 - 295

- 313

- 335

- 361

0.5 - 396

0.8

0-6

But it must also be borne in mind that the rays, being refracted in the layer of water in front of the culture, come somewhat nearer to each other, so that the illumination becomes somewhat stronger than corresponds to the distance. If VV represents the boundaries of the water layer, the thickness of which, E the light source, the ray EF in the water will take the direction FG; the light that fills the angle i will therefore collect on the surface space G, which space it already has in the without water layer distances EK would have taken. If i is the angle of incidence, b the angle of refraction, n the refraction ratio of the liquid, then one has

p. tg b = GH = d.tgi

r d

tgb when the angle of incidence is small (see below) one has

sin i sin b

bye

bye

n.

tg b

In order to get a quantity of light corresponding to the distance A without a water layer, with a water layer one has to calculate the distance

take. If you calculate the refraction ratio of water 3/4, the distance must be the same

P

A+

be 4

The finer adjustment of the box is done by means of two screws (at C), partly so that the distance between the light source and the culture becomes the desired one, partly so that the front surface of the box (ED) is exactly perpendicular to the direction of the light rays used (Li) comes; the success is seen by means of special marks on the sides of the board and on the box (at D), which marks were originally marked by fixing a small piece of mirror glass in the middle of the face of the box and then arranging it so that the mirror image of the arc is thrown back into itself, which only takes place if LiI ED.

The front surface of the box has a circular window (7) made of 1.0 mm thick, plane-parallel ground quartz

plate consisting; this plate is cut perpendicular to the optical axis of the crystal. The diameter of the window is 43 mm and its center is 5 cm above the bottom of the box. So, with the setup discussed above, a straight line from the arc through the center of the window will be parallel with the surface of the board. This is very important when one wishes to compare the effects of different intensities of light by moving the box along the board; because in the opposite case one would, e.g. For example, if the box had been placed further down on the board, not only would its distance from the light have changed, but it would immediately receive rays at a different angle to the axis of the coals, which would have introduced completely new moments (cf pp. 14-15). - Since the arc light does not emanate from a point, but from the crater of the upper coal, from the arc and from the tip of the lower coal, one must define more precisely what is to be understood by the "distance of the light", and this is particularly important , unless the distance is great. It is very difficult to say, with the present knowledge, which measuring point is the best; the first experiments reproduced below (rows 1-36) are all made at the same distance; I have therefore be able to use without hesitation the most convenient measuring point in practical terms, namely the point nearest the culture of the narrow white ring which forms on the positive carbon a few millimeters above the rim of the crater; it also corresponds fairly well to the nearest part of the strongest light, by this ring forming on the boundary between the white and the red-hot part of the carbon Whether I will continue to use this measuring point in the future, will depend on whether one will find out from which points of the coals or of the

before

Bogens emits the greatest amount of bactericidal rays. As long as you always keep the same distance, all that matters is that you measure from the same point in all trials. This distance is checked for each series of experiments, and I use a sheet of metal for this purpose, on which each of the defining points is marked once and for all. If you use fresh coals, the lamp must first burn for about a quarter of an hour for the ring to form.

The whole tin box is filled with the liquid through which one intends to filter the light, usually freshly boiled distilled water. In order to keep its temperature constant, warm or cold water is conducted through the spirally wound lead pipes (R); the water leaves the box again through the other end of the tube without having come into direct contact with the liquid of the box. – In the center of the box there is a paddle wheel (P) mounted on a continuous shaft, which is kept in lively rotation by a small electric motor (Q. In order that the water can be stirred as completely as possible, the paddles are fastened crookedly on the axle, see above that in addition to the rotating movement of the water you get a strong current in the direction perpendicular to it.The speed of the motor is regulated by switchable light bulbs.

The temperature of the water is read on the thermometer S; its container is protected from direct rays by a small screen. At T there is an opening for a thermometer with a blackened case to be placed immediately adjacent to the culture, directly exposed to the light. – The whole inner side of the box, as well as the lead tubes, are matt black to protect the culture from reflected light.

At a certain distance behind the quartz window (at oo) there is a metal link into which a brass frame, which supports the culture apparatus by means of springs, can be inserted. In the following experiments I used a "humid chamber" with a hanging drop as the culture apparatus; the cover plate is cut out of plane-parallel ground quartz, perpendicular to the optical axis. The thickness of this cover quartz is 0.2 mm; after the culture drop is attached to its bottom surface, the cover quartz is stuck to the slide; this has a spherical segment-shaped excavation, 1 mm deep, 14 mm in diameter, into which the curved surface of the culture drop protrudes freely. The distance between the front face of the cover quartz and the back face of the quartz window, or in other words the thickness of the light-filtering liquid layer, can be changed at will; in the experiments described below I always used a distance of 25 mm. (In later versions of the apparatus I change the thickness of the water layer by fixing the quartz window in a tube that can be adjusted with a thread.)

In the figure one sees at u a small cover which, moved by means of a small handle, can expose the quartz window to the light and cover it again. NE is the lid of the box; it is placed in such a way that when it is open it shields against the light, so that the culture apparatus can be taken out and put in without getting light on it; of course, they must also be protected from light during transport to and from the crate.

The advantages of this apparatus.

1. The optical conditions are simple. If the lamp is maintained at constant amperage and voltage, as discussed, with the same type of carbons without shifting the arc or the direction of the crater, the intensity of the light striking the front surface of the quartz window will depend on the distance, the emittance and the angle of incidence; these three quantities are all precisely known. The refracting surfaces are approximately (cf. below) perpendicular to the direction of the rays used. The reflection and the refraction are as simple and clear as possible, since there is only a plane-parallel layer of distilled water between the light and the culture, from of known thickness and between two plane-parallel cut quartz plates. Also the surface of the culture is plane and perpendicular to the rays, being formed from the side of the drop which is now composed of a solid or liquid medium touching the cover quartz. Because the posterior convex Since the surface of the drop is concave all over against the light, it has unimpeded access to every single part of the drop Only if the drop were made to be curved to form more than a hemisphere would the reflection cause some parts of the interior of the drop to be visible drops come to rest in the dark, but it is very easy to make the drop as flat as you like to shape, and when set down with a platinum eyelet of the appropriate size, it will take on an appropriate shape of its own accord. The broth drop I used was 1.3 x 2 mm wide from side to side, 0.05 x 0.15 mm deep front to back.

Under these simple conditions one can find out, both by calculation and by direct experiment, what percentage of the light used reaches the culture drop. For the time being I have not made an exact determination of these ratios, simply because I have not yet had any use for them. To be on the safer side, I only calculated individual limit values: We get the ray that deviates the most from the normal of incidence, which can be imagined under the given conditions, if we place two slides next to each other in the apparatus and if we look at each of the two cover quartz has deposited four drops and when the cultures are illuminated by the light at the shortest distance; I chose 280 mm as the shortest distance for practical reasons. The outermost point of the outermost drop is then at most 18 mm to the side of the center line (ie the line connecting the center of the light source and the center of the quartz window). The most deviating beam is then the one that z. B. falls from a point of the extreme right part of the upper charcoal towards the extreme point of the culture drop lying furthest to the left. But even such an extreme ray deviates only 5° 52' from the perpendicular where it hits the quartz window - what is more, this ray and its nearest neighbors only have an extremely low luminous intensity because their emission angle is almost 90 ° is. But even if one wanted to calculate that some of the rays have an angle of incidence of approx. 6°, this only plays a negligibly small role from a practical point of view. According to STOLZE (cited by EDER), the light loss due to reflection from a flat glass plate at an angle of incidence 0' is < 0.6%, at 50 = 1.5"o, at 15o = 3.4% o'

0 So none of the rays used would produce more than approx. 1.3%

0

10

0

lose, the majority of them even less. I have not been able to find in the literature how the reflection from a quartz plate behaves, but I can casually assume that it does not behave essentially differently than with glass. Concerning the visible rays, Mr. ABSALON LARSEN found by direct experiments that at the angle of incidence

approx. 0.35% is reflected from the quartz surface. The reflection on the boundary surfaces quartz-water (where the discussed "unfavorable ray hits at 3° 48'), water-quartz (4° 24) and quartz-nutrient medium (3° 48') can certainly be neglected in practice because the difference between the refractive indices of these substances is so small. Inside the nutrient medium itself, the most unfavorable ray will deviate only 4° 20' from the normal of incidence. During these different refractions (where the indices of refraction for quartz, water and medium are set at 1.54, 1.33 and 1.35) the most deviating ray will have approached the center line 0.74 mm; I have already taken account of the resulting concentration of light, which, as can easily be proved, occurs regardless of the entire illuminated area when calculating the distance (p. 17).

So while the light intensity suffers a small attenuation because of reflection, it is, on the other hand, amplified a little by reflection from the rear surface of the nutrient drop, which causes part of the light to pass through the drop twice. This amount of light will not be large, and in similar experiments it will be approximately the same each time.

The absorption loss is also very small. One usually wishes to have a certain kind of absorption, namely of a part of the ultra-red heat rays, which are held back by the water layer in particular, and also partly by the quartz. For the other rays, including the ultraviolet ones, quartz and water are the two most permeable materials that can be considered; As far as certain invisible rays are concerned, this is already clear from my experiments discussed on p. 6 in relation to quartz. For the visible spectral range, H. RUBENS and E. ASCHKINASS say that quartz has "an almost perfect" permeability, so that the absorption loss could not be measured at all.

2. The light intensity can be graduated with accuracy. Since it is not possible to vary the intensity of the light source according to a sufficiently precise scale, and since the various methods of measuring light have hitherto been cumbersome and imprecise, and sometimes completely unsuccessful when it comes to determining the ultraviolet rays, this is the case , as far as I can see, the most accurate method of obtaining various definite light intensities is to use the lawful decrease in light intensity inversely proportional to the square of the distance.

Conversely, in this apparatus we shall have a measuring apparatus for determining the abundance of bactericidal rays from a light source (e.g., a light-gathering apparatus). Such a measuring apparatus is all the more necessary as we hardly know which part of the ultraviolet rays is most bactericidal - far fewer have been able to measure their quantity.

3. The light absorption of the nutrient medium is limited as far as possible by using it in very thin layers of 0.05-0.15 mm in the subsequent investigations. – A provisional provision

According to Mr. ABSALON LARSEN, both agar and bouillon absorb in layers of a few millimeters about half the rays acting on silver chloride, and it may be expected that the bactericidal rays will be absorbed at least as much. On the other hand, I conclude that the absorption plays no practical role in the very thin layers just mentioned: although in most of my experiments I intentionally placed a somewhat thicker drop next to a very thin drop, I was unable to demonstrate any constant difference in the results. At the limits where the bacteria often grew in one of the drops (usually four) deposited on the same covering quartz while the remaining drops remained sterile, the bacteria grew in one of the thin drops just as often as in one of the thick ones. Of course, the thickness of the drop cannot be entirely without influence; but I can say that it does not matter as long as the gradations of the illumination times are not made smaller than in the subsequent experiments. I hope to be able to show later how the exact limit for the largest permissible droplet thickness can be determined by the apparatus itself.

Incidentally, this is not the only advantage of the hanging drop. Apart from the fact that, as discussed above, the side of the culture that faces the light is made completely flat, one also achieves that the oxygen has very easy access to the whole culture, since the hollow space of the slide is many times larger than that Drops of culture, a circumstance to which one must attach all the greater importance, as several investigators stated that they had obtained different results, depending on whether the exposed test tubes, etc., were more or less filled with the nutrient liquid. A big advantage of the drops is the small space they take up; you can without difficulty z. For example, four drops can be deposited on the same covering quartz, and two such (with four drops each) can be placed next to each other in the apparatus, or if each slide has two hollow sections, a total of 16 drops without any ray getting a less favorable direction than calculated above. If, on the other hand, larger culture containers were used, a corresponding number of these would take up so much space if they were to be illuminated simultaneously that a possible tilting of the crater would cause a very significant difference in the amount of light hitting each individual. Finally, the smallness of the drop allows one to conveniently measure the effect of a narrowly defined zone of a given field of light, e.g. B. a certain region of a spectrum can examine.

The fact that all exposed bacteria are accessible for direct microscopic examination can also be of importance.

The possibility of drops placed on the same covering quartz infecting each other cannot be totally ruled out, although a glance at the tables below will show that this is very rare, if it occurs at all. I haven't seen a case where I suspected it was happening. But in order that such an objection could not be made, I only ever put together those drops that were taken from the same culture; now if one sees outgrowth in more than one droplet, perhaps a skeptic might assert in each case that one droplet infected the others; but in one of the drops, he has to admit, the bacteria weren't all killed. And as for the drops, which remain sterile after exposure, no objection can be raised (see, by the way, "The Explanation of the Experiments", p. 78).

Before me PANSINI and partly KRUSE used the drop method, both in experiments with sunlight and with the use of coverslips. PANSINI's experiments are only known to me through a short report; he is said to have found that anthrax bacilli are killed in 70 minutes. KRUSE has achieved similar results (Summer Sun, Naples), but he only used the method in a few experiments, which he describes so incompletely that I don't feel obliged to go into more detail.

4. The temperature conditions are taken into account. Above all, it is important to make sure. that the temperature of the culture medium does not rise so high that the death of the microbes could be due to the heat. The culture is cooled by being flushed with water, which is kept in lively, flowing motion by the motor. Since the covering quartz is thin and the quartz is also a comparatively good conductor of heat, and since the drop is very thin, the conditions are particularly favorable for keeping the culture at the same temperature as the surrounding water. In order to see to what extent this reasoning corresponds to the actual situation, I have made the following experiments:

The easiest and actually already convincing is to illuminate one's own finger at the place of the culture. Even at the shortest distance from the light (128 cm.), and even if the finger was blackened, when the engine is running at a suitable speed, no other warmth is felt in the finger than that corresponding to the temperature of the water while one is outside the box in it feels intense pain after less than a minute.

For the sake of greater certainty, I have made numerous experiments at very different water temperatures and placed a thermometer with a sooty container through the opening T (see the figure) directly next to the culture. The temperature difference between this thermometer and the shaded one (S) never reaches '/4 Finally, the following experiments seem to me to be completely convincing: On the rear side of the cover quartz, directly next to or between the culture drops, I attached small cubes, which are made of materials with different melting points (butter, Vaseline and in particular various paraffins with melting points 41.50 450.50). You can illuminate them for any length of time, at a distance of 28 cm, without melting them, if the temperature of the water is kept below the melting point of the substance in question; if the temperature of the water is allowed to rise, the cubes will not melt until the shaded thermometer shows temperatures at most 2 below the actual melting point. Even if these substances are kneaded with soot, this ratio remains almost unchanged. In all experiments below 36.5, the cover quartz is glued to the slide using yellow vaseline (mp. 36.;o); as soon as the temperature of the water exceeds 36.5°, it immediately melts and the cover quartz sinks to the bottom; at all temperatures up to 36. the petroleum jelly shows no sign of melting, even after hours of illumination.

Of course, the effect of heat rays is not completely excluded if the thickness of the water layer is only 25 mm and the distance is 28 cm. But it is not the intention at all, at least for the time being, to rule them out completely, since it is probably most natural to begin the investigations with a light that contains all the elements, including the heat rays; only it is necessary, by means of the water and the quartz, to switch off so large a part of the heat rays that it is possible to keep the culture drop at the temperature selected in the individual experiment. In other words, it is not the heat rays as such that are to be avoided, but too high a temperature of the culture liquid, and that we have prevented this is shown by the tests discussed above.

Also for practical reasons the effect of the heat rays must be studied within these limits; for if it turns out that they have a bactericidal effect, they could very well be used therapeutically because, as discussed, the skin nerves have no objection to lighting under these conditions.

But I don't confine myself to keeping this temperature so low that it cannot harm the bacteria; I also keep it constant in each series of experiments, because it could be quite probable a priori that the light effect will not be the same at all temperatures, which is also confirmed by my experiments

see p. 93

5. Agitation using a paddle wheel does three things: First, it maintains the temperature throughout the box regardless. Secondly, the discussed experiments with paraffin cubes have shown that the temperature in the humid chamber cannot be kept equal to the temperature of the surrounding water unless stirrers are used. Third, it prevents dust particles and similar unavoidable contaminants from settling on the cover crystal. Otherwise, a speck of dust that is barely visible to the naked eye would be enough to provide shade for some bacteria, which could later colonize the whole drop, at least if liquid nutrient medium is used.

Precautions when using the

apparatus.

The quartz plates must be completely clean. An almost invisible film of dirt suffices, as has been shown on many occasions (e.g. our experience with therapeutic light-collecting apparatus), to reduce the effective amount of light to an unexpected degree. The quartz window must, therefore, be carefully polished on both sides immediately before the start of the experiments, and during the experiments constant attention must be paid to it and every speck of dust and the like. remove by means of small instruments specially designed for this purpose (a fine brush for the outside of the window, a buff made of glove leather for the inside of the window). In experiments lasting only a few seconds, these manipulations must be carried out before the culture is placed in the box; if the experiment lasts longer, it makes no difference whether you brush away a speck of dust with a quick movement. Just as much effort has to be put into the cover quartz. Before the experiment these are washed in Sprit, carefully dried, every visible speck removed with a brush; then each one is wrapped in smooth paper and, like the corresponding slides, sterilized at 140°. After the culture drops are removed by means of a platinum loop of a certain size on the underside of the cover quartz

placed, this is glued to the slide using sterile vaseline; if temperatures above 35° are to be used, a layer of Unguentum cerae (Ph. dan.), which only melts at 58°, is laid around the edge of the covering quartz. Care must be taken not to get a trace of petroleum jelly on the front surface of the cover quartz because even the thinnest layer can block the majority of ultraviolet rays as petroleum jelly is very fluorescent.

Another significant source of error can be the water in the box. You have to use freshly boiled, distilled water; otherwise it is difficult to prevent the formation of small air bubbles, which settle on the top quartz, among other things. A tiny air bubble is enough to protect a whole lot of bacteria from the light, and until I realized the importance of these bubbles I found it impossible to get any consistent results at all. If you use a liquid other than distilled water, you must not forget that the absorption ratios are different. Even ordinary tap water absorbs the majority of ultraviolet rays. Care must also be taken to avoid electrolytic effects as far as possible by careful varnishing, so that no metal salts are formed.

2) Experimental protocol I.

Variations in the resistance of B. prodigiosus according to the age of the culture and according to the temperature of the

culture medium.

1

In what follows I do not confine myself to communicating my results, but I reproduce verbatim my experimental protocol, even the failed experiments, because the development of the experimental mode is not without a certain interest.

The following relationships are common to all experiments in this first protocol (series 1--36):

The lamp (shunt lamp by Siemens & Halske). Positive carbon 24 mm diam., negative carbon 15 mm diam., current 35 amps. The rheostat available in test series 1-33 functioned somewhat poorly, so that the amperage could not be kept exactly at 35; she was kept between 35 and 353, a., averaging at 35'13. If 35 A. is noted in the test protocol, this margin is meant. If now and again a major fluctuation has occurred, it will always be found explicitly noted. From row 34 onwards a rheostat was used, which I had so made that arc lamps could be switched on one after the other or several at the same time, in parallel with the main resistor, whereby the amperage could easily be kept so constant that you could hardly see the oscillations on an ordinary ammeter. The voltage was kept between 50 and 52 volts as far as possible and is noted for each individual experiment. How great an influence on the amount of bactericidal rays variations in current and voltage have within these limits must be left to later experiments. It is usually stated that the intensity of visible light increases slightly more than proportionally to the current. According to ABSALON LARSEN's experiments (see later) one can calculate that a variation of the current intensity from 30 to 31 amperes corresponds approximately to a 5% increase in the luminous intensity in the region of the Kund H lines. Through experiments with silver chloride paper I myself came to similar results. A large part of the small irregularities within the individual test series could already find a plausible explanation through this source of error. But for the time being it must be noted that, according to other experiments carried out at the Light Institute, the strength of the bactericidal rays does not seem to increase in proportion to the rays acting on silver chloride.

The light filter always consisted of distilled water with a thickness of 25 mm (in addition to the two quartz plates).

The test object was always B. prodigiosus in pure culture. At appropriate intervals, I satisfied myself that the cultures were still pure. Both the cultures and the sterile nutrient medium were always kept in the dark; when retrieving them, I always avoided direct exposure to sunlight or arclight. After the lighting had ended, the culture apparatus was placed in the incubator, the temperature of which was 20-22° in rows 1-30 and always 25 in the later rows, because it was impossible to keep the temperature of the incubator constant at 20° in the hot summer time.

In all doubtful cases, the diagnosis "growth" or "death" was confirmed by inoculation into fresh culture medium.

The nutrient medium was always as light as possible, weakly alkaline veal bouillon, prepared according to the general instructions in SALOMONSEN's bacteriological technology. When salts or similar ambiguities began to separate, a new portion was prepared. The bacteria were cultured in test tubes of constant size and shape, each containing exactly 2 cm 3 of broth.

The distance of the light source from the front surface of the culture was always 280 mm. Since part of this distance is occupied by a 25 mm thick layer of water + 2. mm of quartz, the luminous intensity, according to what was developed on p. 17, would have corresponded to a distance of 273 mm without the intervention of such refractive media.

The time was measured by a chronograph, which allowed 15 seconds to be read.

Explanation of the tables: A = ampere, V = volt, sec = the time that the culture drop in question has been exposed to the light, given in seconds. (means that the culture was not illuminated at all, i.e. control experiment; the temperature specification in such a case means that the culture was exposed to the relevant temperature in the box without illumination. 1 h., 2 h. or 1 d., 2 T. indicates the number of hours or days that have elapsed since the illumination at the point in time at which the individual culture drops are examined + means that the bacteria have grown diffusely throughout the drop • that the drop remains clear i.e. without visible growth. s means that the bacteria have grown "scattered", o: they have grown only in individual circumscribed parts of the drop (I will come back to the explanation for this later). In rows 1-6 I don't have between + and s distinguished, and I am

also not sure I defined "S" in the first 12 rows in the same way as later. If there are several +, or or s in one category, this means that a corresponding number of separate drops have been placed on the cover quartz in question.

I have used italics throughout the experimental protocol for those remarks which I later added to the original text written during the experiments.

These preliminary attempts seem incomprehensible. Even 3000 seconds doesn't always seem enough. But the culture illuminated for 3000 seconds gives a clue to the right way; it turned out that there was a very thin layer of petroleum jelly on the coverslip. Perhaps the small air bubbles that formed on the cover quartz could also play a role.

Row 5. (9/2. 99.)

All air bubbles are removed as soon as they form.

#2 grew out in what we later call "dispersed."

We see that after removing the air bubbles, the bacteria are killed in less time than row 1.

In order to completely avoid the formation of air bubbles, boiled distilled water is used here (as in all later experiments) immediately before the experiment. Continued cultivation reveals that the adult colonies are truly Prodigiosus.

So now some will be killed in as little as 300s 5mins.

Row 7. (15/2. 99.) The window is now (as always later) carefully placed immediately before the ver

cleaned with hydrochloric acid, petrol and water and then polished.

ss 3, 5 and 11. It is determined by continued inoculation that it really is Prodigiosus.

As the drops have hitherto been taken from more or less old, strongly red cultures, the possibility arises that the inconstant results could be due to the pigment fragments. Darım experiments are now being carried out with very young cultures; but because one does not attach great importance to the age of the culture, at the same time ler become. search made with different temperatures. The exact age of the culture is also not noted.

Nos. 5 and 6 were found sterile by vaccination.

Dropped by a very young culture.

In this series (as in all the following ones) the moist chambers are removed blindly from the series of finished preparations as a control, so that the order in which the drops are deposited has no influence; only then are they provided with buzzers and illuminated.

The lamp regulates badly.

Nos. 3-7 are inoculated in one and the same jar with broth; the same remained sterile.

With series 10 and 11 we have a whole new picture: consistent results and sterilization in less than 120 sec. To see if this could be due to the temperature being 10" while in the previous trials it was 30" was, the following test series is made:

No. 10 failed in that the cover quartz slipped off because the petroleum jelly melted; in No. 9 it got stuck, although the vaseline melted immediately here too.

Nos. 7 and 8 were inoculated in broth; this remained sterile.

According to this, it is hardly the temperature differences that were decisive in series rou, 11. Rather, one had to try to determine the influence of the age of the culture.

From No. 12 is inoculated in broth; this remains sterile.

No. 1-5: The drops were from a 6 hour old, still clear broth culture.

No. 6-9: Ditto from a 30-hour-old, just unclear broth, No. 10-12: Ditto from a 54-hour strongly unclear broth culture.

So age seems to matter. The 6 hour old culture was killed between 60 and 120 s while the 54 hour old took between 180 and 360 s.

No. 1-9 separated from approx. 6 hours old, still clear broth culture. No. 10-16 from approx. 56 hours old, highly unclear broth culture.

The influence of age seems unmistakable again; but closer examination shows that this series is only slightly convincing in this respect, for the 6-hour-old culture was (for an unknown reason) already very weak before illumination, since then the growth of the control drops was scarcely visible even after 24 hours and because the culture was sterile after only 20 seconds of illumination, which is quite abnormal (see, e.g., the following row).

15. 1-16 from a 6 hour old broth culture.

In this series, as in most of the previous series, the duration of the illumination was chosen unfortunate, so that the killing limit does not come to light clearly. From the next series of experiments onwards, based on the E's made in rows 1-15, I am; experiences, been happier in this respect,

Nos. 1-25 from about 8 hours old, clearly unclear culture after dilution with equal parts broth so that the mixture from which the drops were taken was almost completely clear.

Since I did not note the time elapsed between dilution and illumination, it is unclear whether the culture should be assumed to be 8 hours old or very fresh.

No. 1-25: 2 platinum loops (otherwise only 1) from 24-hour-old cultures are inoculated 8 and 9 hours before the start of the experiments in 2 cm3 of sterile broth; the drops are taken from this immediately before the start of the experiments.

Nos. 8 and 16 are inoculated with sterile broth on the 3rd day; the same remains sterile.

Nos. 1-10 from a culture established at 11/2 A.D., Nos. I--23 at 4 A.D. Illumination began at 81/4, completed at 91/2. The order of attempts: 1, 2, 3, 11, 12, 13, 14, 15, 4, 17, 5, 18 etc. Both kul. tures are sown from one and the same culture; this was then 24 hours old. Thermostat 220.

So culture 1-10 is a little over 7 hours old, culture 11-23 about 5 hours old. From No. 8, 10, 20-23 is inoculated into sterile broth on the 5th day; this remained sterile.

No. 15 is sterile even after vaccination. - Nos. 1-8: i loop from an eight-day culture, which was already beginning to turn red on the surface (room. temp.), is transferred to 2 cm3 of sterile broth, from which, after shaking, the drops are immediately deposited and illuminated will. - No.9–15: 3 eyelets, ditto by the way.

No. 16-25: 12 eyelets, ditto by the way. Nos. 24-25 are placed in 30° water without lighting for 3 min. Experimental order: 1,9,16,2,10,17 etc.

The safe kill limit was not reached.

Finsen, Medical Light Institute.

No. 1–6: approx. 2 h old culture, sown from 24 h old culture (2 eyelets Clear at the beginning of the experiments.

No. 7-12: approx. 6 h. old culture, 2 loops sown from the same culture w. 1-6. Slightly cloudy at the beginning of the experiments.

Nos. 13-21, from a culture from 1 to 2 months old, which was bright red with a sediment over which clear liquid; the latter is decanted and the dregs transferred to 2cc of sterile broth, which thereafter did not appear significantly turbid; from this the drops were taken.

8-12 and 14-21 were illuminated in pairs next to each other (8 next to I. o next to 15, 10 next to 16 etc.).

In the following series of experiments (series 21), the investigation of the influence of the age of the culture is partly continued by examining cultures with an age of 4-5 days, 11 hours and 4 hours; partly the investigation started in series 19 on the influence of the number of bacteria per room unit is continued. For the possibility could not be ruled out a priori that the greater resistance of older cultures could be due to the fact that the bacteria in them were so numerous that they shadowed one another. Two dilutions were therefore prepared for one and the same culture, so that one (Vr. 20-24) contained about 25 times as many bacteria per cubic millimeter as the other (Nos. 15-19); further, the two older cultures (Nos. 1-14)

greatly diluted that they appeared perfectly clear to the naked eye,

From row 21 onwards, several drops of equal value are placed next to each other on the same deck quars.

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No. 1-24: Two drops of the same species are placed on each covering quartz.

No. 1-6: 0.04 cm3 is measured from a 4 to 5 day old, diffuse red broth culture with a small sterile pipette

and transferred to 2.cc of sterile broth, which then appears unchanged clear to the naked eye. lighting as soon as

as possible afterwards.

Nos. 7-14: From the same stock culture as 1-6, 11 hrs before the experiment a loop is placed in 2.0 sterile broth.

guided. Immediately before the experiment, 0.04 cm3 of this old, freshly prepared broth is transferred to 2.0 broth.

which did not lose its clear appearance as a result. From this, the drops are deposited and immediately illuminated.

Nos. 15-24: When the discussed ni St. old culture was 7 St. old, a loop was made from it in glass A (with 2nd sterile

broth), and 25 loops in glass B (also with 2.0 broth).

Nos. 15-19 are set off from glass A at the beginning of the trials, when the culture of the same was 4 hours old.

vr 20--24 are separated from glass B in a very similar way.

All cultures, 1-24 deposited, were completely clear when illumination took place; 16 hours later they were all equally troubled.

#4

In the last 5 seconds 38 A. and 49 V. VI

-25: Of 6 hrs, old, just cloudy broth culture, 6 hrs are sown in a loop in 2.1 sterile broth before the start of the experiments; this broth will

placed at 220. From this 6 hour old culture, 4 drops are placed on each deck, except for I and 13, where only 3 are placed.

Nos. 18 and 22 were clearly red only after 90 hours.

From a 24 hr old broth culture, 5 hrs are sown in 2.0 broth before the start of the trials; this latter culture, from which the drops are removed immediately before the experiment, has stood at 28° (ie, room temperature). Lighting began at 845, ended at 945, and was done in Vummer order (12-23, half an hour to a full hour older than 1-11 at the moment they were lit).

No. 23 was placed in 360 water for 30 seconds without illumination. 4 drops on each cover quartz.

The temperature could only be brought a little below 180 without the quartz window dew condensation due to the humidity of the atmosphere.

No. 1-25: 1 loop of 24 h old broth culture is sown in the 2nd broth 3 h before the start of the experiments.

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+++++++−++−

11

Age about 3 hours.

13

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15

50

60

4 drops on each quartz.

After lighting, the drops are placed in the unheated thermostat.

Row 25 (repurified culture).(

(12. 99.

13 h 17 h 22 h 37 h 39 h 46 h 3 d

4d

See.

No. 1-31: From 28 hrs old broth culture, at 6 o'clock (ie 39/2 hrs before the beginning of the experiments) i loop in 2.0

Broth sown, from which the drops, 4 on each quartz, are deposited by 9-912. First becomes preparation I, then 31, then 2,

then 30 etc. finished. Illumination in order of numbers, starting around 912, ending around i Chr. Age so 312-5 pcs.

vr 3: The stop in the two drops is caused by contamination by a small cotton thread.

No. 2: Vaccination from the drops convinced of the sterility of the same.

l'on Nos. 5, 6 and 20 are inoculated in test tubes with broth; the culture that emerged here later shows, in addition to Prodigiosus, a foreign Bacillus in all three cases. The remaining drops were discarded by this time.

Row 26. (14.99.) 64 drops were deposited which, with the exception of 4 control drops, were illuminated in 10-20 sec. All remained sterile and it turned out that the drops had been mistakenly taken from sterile broth.

No. 1-19: From an all red culture, on 14/7. applied, is vaccinated 1677. 6 o'clock in the afternoon i eyelet in 2nd, broth. Of this is today vorm. at 8 o'clock, since a narrow red seam can already be seen on the surface, I eyelet is inoculated in 2.0 broth (jar A). 39/2 p.m. were 2 eyelets from A in 2nd, bouillon (glass B) and 6144 pm. inoculated from A 2 loops in 2nd broth (jar C). (The room temperature still 7 p.m.

260.)

From B and C will drop 81/2-9 pm. related to Nos. 7–12 and Nos. 13–19 removed. 91/4 L'hr is transferred from A 0.06 cm3 to 2.0 broth, which then appears unchanged and clear (glass A1). (A itself had long been dull by then.) Nos. 1-6 are deducted from A1 . Lighting starts at 9.30am, finishes at 10.30am

Order of lighting (2 each at a time): (1, 8), (2, 9), (3, II), (10, 17), (4, 12), 5, 6, 14, 16, 18, 15 , 19. The age of A1 is thus 1312-14 hours on illumination, of B 6-61/2 hours, of C 33/4-444 hours.

The number order of Nos. 14-19 is not entirely certain, as some may have been switched during the second viewing.

From a culture that is 18 hours old, it becomes 8 hours in the morning. inoculated in 2.0 broth (jar A). From A, 1 ose is inoculated into 2.0 broth (jar B) at 11/2 o'clock. From A is inoculated at 6 o'clock in a loop in 2.0 broth (jar C).

#1-7 of Glass C, #8-14 of Glass B.

Immediately before the start of the experiment, 0.02 cm3 of glass A is transferred to 2.0 broth; this then appears clearly unchanged, and nos. 15–21 are separated from this.

Glass B was clearly cloudy at the start of the tests, glass C was still clear.

Lighting started at 8.30, finished 9.10.

Lighting order (sometimes two at a time): 2, (3, 9), (4, 10), (5, 11), 16, 12), (7, 13), (14, 20), ii, 17, 18, 19, 21

The age of Nos. 1-7 is therefore 212-3 hrs, of Nos. 8-14 7-71/2 hrs, of Vr. 15-21 = 1212-13 hrs at illumination.

In this series a bouillon diluted with equal parts of distilled water to get a lighter color is used experimentally. However, it turned out that the bacteria in it grew much more slowly and sparsely than usual, which is why this mixture was no longer used.

Nos. 1-5 are 13 hours old when lighting begins. Before droplet deposition, they were diluted enough to remain completely clear.

Nos. 6-12 are 77/2 hrs and Nos. 13 - 19 3:2 hrs old. It is possible that some of the drops marked with were not sterile because even the 8 control drops (Nos. 12 and 13) were so slightly turbid that it was difficult to see with the naked eye. Finsen, Medical Light Institute. II.

5

C

Age 8'/4 hours.

18

270

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97

50-52

From a culture which had always been re-bred through 4 generations before pigment became visible, and which on 31./7. 8 a.m. 8 hours old, all jars A, B, C, D, E, F are vaccinated

. In F, vaccination is given at 8 a.m., in E at 10 a.m., in D at 12 p.m., in C at 2 p.m., in B at 4 a.m., in A at 6 a.m.

Lighting started at 9.45pm, finished at 11am.

Lighting order: (2,8), (3, 9), (4, 10), (5, 11), (6, 12), (13, 19), (14, 20), (15, 21), (16, 22), (17, 23), (18, 24), (25, 32), (26, 33) etc.

From a 442 h. old culture, 6.30 p.m. inoculated in 2nd, broth. Thermostat 250 to 81/2 o'clock when dripping started.

Lighting started 9.40, finished 10 25. Lighting in number order.

No. 14 and 15 were placed in water at 45° for 180 seconds, No. 16 for 300 seconds, without lighting.

The thermostat is also set to 25" for the following rows

711 eat.

450

300 Age: 4 hours. Age: 3/4 hours. Age: 3 hours.

15 0

From 61/2 hr old culture (derived from a 12 hr old culture grown to maturity at 250) becomes 6.30 pm. inoculated in 2nd broth, which is placed at 25°. All drops from 8.45 am to 9.30 am are discontinued. Lighting started at 9.30 a.m., finished at 10.45 a.m., made in number order. No. 2 was placed in 45° water for 120 seconds without lighting.

Row 33 (129. 99). From a culture about 3 hours old, 28 drops are illuminated at 45° in 10-60 s, 24 drops at 300 in 20-120 s, 24 drops at 150 in 20-120 s. 12 drops served as a control without Illumination: All preparations remained sterile with the exception of one of the 4 drops given 10 s light at 45° and one of the 4 given 20 s light at 15° and the 12 control drops; but these latter all grew very sparsely, being only "s" for the first 3 days, only on the 4th day the scattered centers of growth confluent to form a faint diffuse opacity. So why this culture was weakened from the start, I don't know.

From a 1342 h. old culture becomes 14/2 pm. in 2nd broth (jar A) and 4.45 in 2.0 broth (jar B).

Nos. 1-24 are set off from Glass B just before the start of the trials, Nos. 25-49 1/2 hour earlier from Glass A. Lighting started at 9.40am, finished at 11am.

Lighting in number order, but always two at the same time (1 and 25, 2 21, 26 etc.).

A new resistance was used to regulate the current intensity, consisting of 21 incandescent lamps to be connected individually or in groups in parallel with the ordinary rheostat; this allows the current to be held so precisely at 35 amperes that the error scarcely exceeds 1620 amperes. Only during the lighting of Nos. 8 and 32 was the amperage 36 amps for a few seconds while the lamp was self-regulating.

Nos. 24, 48, 49 entered 450 water without illumination, 24, 48 during 2, 49 during 3 minutes. Nos. 23 and 47 received neither warmth nor light, the age from 1--24 4.55-6.15 hrs., from 25-49 8.10--9.30 hrs.

All drops were vaccinated in bouillon glass on the 7th day; all 3 and + showed up as pure cultures of Prodigiosus, all = remained sterile.

As a control, to see if lighting-altered broth texture played a role in the previous series of experiments, 4 sterile broth drops were placed on each of cover quartzes 1-12, after which lighting was undertaken as usual. Immediately after illumination, all drops were inoculated, #1-5 from a 24 hour old Prodigiosus culture, #7-12 from a 4 hour old. After 16 hours, all Prodigiosus drops are irrelevant and very cloudy. It was inoculated with the tip of a 0.2 mm thick platinum wire without a loop so that large amounts of unilluminated broth were not transferred at the same time as inoculation.

It can be seen from this experiment that in the present Ver. look for the light intensity used does not noticeably change the properties of the broth as a nutrient medium at the relevant times.

28%) Row 36. (2. 99.) (continued on pp. 76-77.)

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From a 21 hour old culture, 11/2 C'hr am. inoculated into 2.0 broth (A), and from A at 6/2 Chr. in 2.0 broth (B).

#1-18 of A, #19-35 of B.

Nos. 1-5 and 19-23 are illuminated, 2 simultaneously, 10.25-10.38.

Nos. 6-10 and 24-28 are illuminated, 2 simultaneously, 10.44-10.57.

Nos. 11-16 and 29-34 are lit, 2 simultaneously, 11.05 – 11.57.

So the age was:

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3-55 -4.08 hours

19—23 - 8.55-9.08

6-10 = 4.14-4.27

24-28 = 9.14-9.27

11-16 = 4.35-4.47

29-34 = 9.35-9.47

No. 17 and No. 35 are placed in 45° water for 170 seconds without lighting.

The current is kept exactly at 35 amps, as in the two previous rows.

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150

300

}

450

The explanation of the experiments.

The first 12 series of experiments are only indicative, sometimes rather groping, as will be seen from the notes attached to each series. In particular, an exact indication of the age of the cultures is missing, and since it has turned out that this moment is of decisive importance, I will completely refrain from these first 12 rows in the following. The following rows are not all of equal value either. A special position is occupied by the following series:

Rows 14 & 33: Cultures were already attenuated prior to illumination (see notes in experimental protocol).

R. 15 and R. 19: The lighting time is so unfortunate that the killing time was not determined.

R. 25: The culture was contaminated with another microorganism.

R. 29: The broth used is 50% thinner than usual, so the "age" of the bacteria cannot be easily compared with the age of the bacteria in the other test series.

Besides, the later series are, of course, on the whole more reliable than the earlier ones, because I gradually got more practice and introduced more and more precautions. The experiments from row 21 onwards must have gained in value because from this time on I always placed several drops, usually 4, on each covering quartz. Because in cases where all four drops have given the same result, the test must be regarded as more reliable than if only í drop was dropped. And on examining those cases where part of the 4 drops was sterilized while the rest showed growth, I became aware of circumstances which made me believe that in one and the same culture all individuals are not equally resistant, and namely that a small number of bacteria may be more resistant to the light than the majority of them.

Namely, it turned out to be quite constant that when the lighting time approaches the "absolute kill time" (ie the lighting time that kills with certainty all individuals of the culture), growth occurs only in a part of the drops on the same cover quartz, im others don't. Looking through R. 22-36 it is difficult to avoid the impression that some bacterial individuals in any bacterial culture must be more resistant than the others because they can withstand a period of illumination to which their otherwise equal comrades are subject. We see further that the most resilient are in the minority against the weaker; for in each sterilized drop there were originally hundreds or thousands of bacteria, not one of which has shown resistance, while each drop in which growth occurs proves nothing but that at least one resistant micro-organism was in it. And the higher grades of hardiness are found, on the whole, in diminishing numbers as hardiness increases; for as we approach the absolute time of death it becomes constant that out of the 4 drops at most one shows growth, and where the times of suitable magnitude have been chosen we see a fairly even increase in the number of drops sterilized on each Top quartz (see e.g. BR 30 to R. 36). We often see that there was not a single living bacillus in the 4 drops, while all 4 appear to be sterilized, although the absolute kill limit has apparently not yet been reached, in that we see growth again in one on the next or perhaps only on the second next covering quartz see individual drops. So we saw z. B. in R. 23, Nos. 12--22, how at 20 sec. illumination all 4 drops show growth, at 30 sec. 3 of 4, at 40 and 50 sec. I of 4. at 60 sec. O of 4, at 70-90 seconds again i of 4, at 100 seconds and above o of a total of 12 drops. If a sufficient number of drops had been deposited in No. 15 (60 seconds), a certain number of them would probably have grown. The same can be said of #20-22 (100 sec and up), but with far less likelihood.

It is therefore necessary to have an overview of the whole series before one can assess the extent to which sterility of all 4 drops indicates that the safe kill limit has been reached. Of course, the likelihood of the latter being the case is much greater when the preceding numbers have already shown an increasing number of sterile drops. For this reason, in R. 13---20, where only í drops have been placed on each cover quartz, the killing limit cannot be determined with such great accuracy as in the later rows. if e.g. B. No. 15 in R. 16 is sterilized, this is obviously analogous to the fact that e.g. B. No. 3 in R. 22 has 3 sterile drops under 4. The killing limit in R. 16 is apparently somewhere between 60 and 120 seconds, even 120 seconds would not be reliable if we had not just seen that already at 20 and 30 seconds (ie Nos. 15 and 17) numerous individuals had perished. Those cases, incidentally only a few, are more difficult to interpret in which, as in R. 22, Nos. 13-24, growth suddenly appears in a single drop of 4 after a large number of sterile numbers. Whether that means in this case that the kill limit is above 120 seconds, or the number of resistant individuals in this culture was unusually small, or whether Nos. 18 and 22 as

" coincidences" are to be understood that have remained in life, e.g. B. because some bacteria were shadowed by a speck of dust, or because of other experimental errors, cannot be seen from the series itself. On the other hand, the interpretation of this becomes less difficult when we see the results of these series next to those of the other series (see below) in a graph. if e.g. B. No. 12 in R. 31 shows growth in a single drop out of four, while the next preceding two numbers (10 and 11) with a total of eight drops were completely sterilized, and the cultures with an even shorter illumination time (No. 9) were already had a few sterilized drops, it becomes probable that No. 12 is due to "accident," namely when we also see that in all other rows with cultures of corresponding age the kill limit is about half the illumination time of that for which #12 has been exposed (see the graph, Table 1, where #12 is set off as a small circle).

My view that only a few individuals in each culture are more resistant than the majority of bacteria is also confirmed in the study of "scattered" (designated s) colonies. Without wishing to preliminarily enter into this interesting phenomenon, I will only state how this form of growth shows up for direct observation.While all unilluminated control drops from the growing culture are diffusely cloudy after about eight to ten hours, the scattered growth always appears later (at the earliest 15th to 20th hour) and disappears from one or more discrete points in the drop. Such a point shows up, where at the earliest I have observed one so far, as a pile of bacteria just visible to the naked eye, stuck directly on the underside of the covering quartz. Microscopically this pile consists of fins, medical light institute II.

from densely packed masses of bacteria, while growth is observed nowhere else in the liquid, only a few evenly distributed bacteria, which are evidently the bacteria originally present in the drop but killed by the light; for their number remains constant in the following days, while the s-point grows very rapidly into a compact hemisphere of up to mm in diameter, with rapid, vivid red pigment formation, which is usually evident from the 24th hour (while the diffusely growing cultures only take on a diffuse reddish color quite late, around the third or fourth day). Only in rare cases (see test protocol) does diffuse growth occur in the drop around this bacterial colony. In most cases such a s-colony remains unchanged for days or weeks, and there are no signs of growth anywhere in the surrounding broth, either macroscopically or microscopically. On the whole one can say that the shorter the illumination time, the more numerous are the s of the individual drop. Where all four drops give s (e.g. BR 36 No. 24), there are usually several, up to ten; where only some of the four drops show growth only ís are found, rarely a pair in each drop (e.g. BR 36 No. 26); in isolated surviving cultures (such as #23 or #28 of the same row) only one at a time. This scattered growth, starting from isolated points, the number of which decreases with increasing illumination time, corresponds in its proportions to the circumstance discussed (p. 79), that the number of sterilized drops on each cover quartz increases with the illumination time, and can probably, like these find the simplest (but of course not the only possible) explanation in that only a few individuals have been more resilient than the majority. – The cause of this individual resilience I will discuss in more detail below. The causes of them growing as a clump and not growing into the rest of the drop are as yet unknown to me.

I have discussed earlier (p. 10) that an actual attenuation has not yet been proved by the commonly used BUCHNER method, but that what has been taken to be an attenuation can be explained by the fact that part of the bacteria of the affected culture is dead and only a part of them remained alive, without one being forced to assume a reduced vitality of the surviving individuals according to the earlier test results. On the other hand, I believe that one can perceive an unmistakable weakening in my test series. When the cultures are examined for the first time after illumination, usually 12-15 hours later, we see that the illuminated drops are almost always quite clear, while the control drops are all very cloudy. It will be seen in the test report that only exceptionally does a culture endure 30 seconds of illumination without being delayed in its development, indeed 10 seconds are usually sufficient, sometimes as little as 5 seconds, to bring about this result. On the whole we see an increasing delay in development with increasing duration of illumination; where one is not seen in the tables, it is simply because the first peak of growth has not always been noted immediately, the results being noted only at certain times of the day (usually morning and evening) for practical reasons, R. 24 shows that by observing the culture at sufficiently small intervals, a certain proportionality between illumination time and growth retardation becomes evident. Incidentally, this relationship can be seen clearly enough, e.g. B. R. 14 (10-16), 18, 19 (1-23), 20, 21, 23, 25, 27 (-12), 28, 30, 34, 36 (29-34).

Now it might be objected that this retardation of colony growth might be due to the fact that most of the bacteria had been killed, leaving so few bacteria alive that it took them longer than usual to populate the drop to such an extent that that the growth was visible to the naked eye, or in other words that there was also a reduction in the number, i.e. a thinning, but no weakening. On the other hand, the following should be emphasized:

1. Only a single surviving Bacillus should be able to populate the drop faster than after 50-60 hours (r. 21.6, 24.11, 28.20, 30.27, 14.35, 36.32) or even on the 4th day {R. 18.9, 23.6, 30.22, 34:6). 2. We have seen how isolated surviving bacteria (namely s,

the "scattered ones") can very well give a clearly visible growth quite early (e.g. BR 22 within 19 hours, R. 23, R. 24 and R. 25 within 17 hours, R. 27 within 14 hours), but where they have been illuminated near the kill limit, they nevertheless often emerge very late (e.g. BR 36.32, 34.6, 30.22 and many others).

3. In R. 24 we see how an illumination time of 1-3 seconds can delay development. It would be artificial to assume that an illumination time of as little as 1 s would have killed the majority of the droplet's inhabitants in a culture where the absolute kill limit is higher than 50 to 60 s.

4. We often see that both the diffusely growing drops (+) and the scattered ones (s) are delayed. It would take a very complicated hypothesis, as far as I can see, to reconcile these four facts without assuming an attenuation of the bacteria.

Incidentally , I am far from proposing the theory of few resistant individuals in each culture, or the theory of the attenuation of individual bacterial individuals by light, than proved by my experiments. I am only offering it as the simplest explanation I could find. Nor do I base the following conclusions on these theories.

Therefore, when I use the word "attenuation" in the following, one need not understand anything other than the fact that the culture in question matured later than the control cultures, and by "dilution" I mean only the fact that only a part of the drops located on the same covering quartz has shown growth.

I need not here dwell on what is known of the two relations discussed, examined by attenuating agents other than light. I just remind you that it was also believed that "exceptional cells" could be proven in other ways,

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individual individuals who behave in certain respects differently from the main body of bacteria in the culture in question.

The influence of the age of the culture.

Although individual earlier investigators have given the approximate age of the cultures used, I have not been able to find in the literature a systematic study of the influence of age on the resistance of bacteria to light.

That the resistance of the Prodigiosus to the light increases with the age of the culture is proved by all the experiments aimed at it, namely the series 13, 14, 18, 20, 21, 27, 28, 29, 30, 34, 36, and nowhere speaks one conclusive attempt against it. Everywhere we see that the absolute mortification time (p. 79) is shorter for the younger cultures than for the older ones.

Within each of the series mentioned here the temperature has been kept constant, the young and the old cultures have been illuminated either simultaneously or immediately one after the other, often alternately. In general, the old and the young cultures within the individual series of experiments were treated in exactly the same way from beginning to end. The proof is therefore, as far as I can see, compelling. Incidentally, it is not only the absolute killing time that increases with age; we also see that the "dilution" (p. 84) occurs in accordance with this. It is, so to speak, constant that the dilution in the younger cultures shows up after shorter lighting times than in the older ones, and,

the times of illumination being happily chosen, we see that under an illumination which gives a great dilution in a younger culture, a weaker Ver

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thinning to stand in the older cultures (e.g. BR 34, #3 & 29. #13 & 37, #21 & 45, R. 36, #2 & 11 & 29).

If one now also compares the various series with one another and also wants to include the experiments that have been carried out in other respects (e.g. to investigate the influence of heat), one cannot, of course, expect a mathematically exact agreement among experiments based on are spread over a period of half a year and during the course of which the experimental technique gradually developed. It must be all the more convincing if these experiments, placed side by side, nevertheless yield a reasonably uniform result, so that the smallness of the variations is rather surprising, when you consider how capricious the growth conditions of bacteria often turn out to be.

In order to be able to record the results graphically in an easily understandable form, one must take into account that the killing time in the method used is not specified by a single specific number, only a greater or lesser range within which it must lie being found Has. if e.g. For example, if no. 13 in R. 34 has fully grown, despite 60 seconds of illumination, while no. 14 and the following have been sterilized with at least 100 seconds of illumination, the kill limit is probably somewhere between 60 and 100. On the In the graph I shall indicate such an attempt by a vertical line drawn solid to 60 and thence dashed to 100. The dashed piece then gives the

. leeway, and the kill limit can be thought of anywhere within it; in many cases one can judge quite well at which point if one surveys the series in question as a whole, taking into account the "dilution" and the "weakening".

the margin, the probable kill limit, lies. but

not to introduce a moment, that's more or less

seems arbitrary, but I have such a curve for the

probable kill time not reported. The one, who

is interested in such a

be able to construct protocols.

In Plate I I have the most complete and uniform

most of the test series, namely all the

searches that are made at 30" and with more than one

Drops on each cover quartz. I just ruled it out

R. 29, where a different kind of bouillon than for the other

search is used (by the way, the relative values, namely

ly the increase in resilience with age, which

same as in the other series, but the absolute values

for each individual age group are slightly different).

Table II

In the main features, the same picture emerges if I also include all other rows where the age is given at all (Table II), i.e. both the rows where the death limit is determined less precisely because there was only 1 drop on each cover quartz , like the experiments where temperatures other than 30° are used (namely 15, 18, 209, 260, 36'). But I don't have the attempts. taken at 45°; because although also

this shows the influence of age in the same way, but here the absolute values are so different, precisely because of the temperature (see p. 93), that they would only make the interpretation of the picture more difficult. I have further excluded R. 14 (see the note on this in the test protocol), R. 15, 17, 19, where the kill limit was not reached at all, R. 22 (13–24), where the limit is uncertain, R 25 where the culture was contaminated, R. 29 where a different kind of bouillon was employed.

I did not take R. 16 with me because it is doubtful how old it can be attributed (cf. note on R. 16).

We see that the picture (Plate II) has retained the same character, in spite of the fact that some cases that are not entirely pure have been included: resistance to light increases with increasing age.

Some experiments could indicate that we have already reached a maximum of resistance at the age of approx. 12 hours, in that cultures of 2-3 days (r. 13 and 14) and of 1-2 months (r. 20) appear no more resistant than the ui à 14 St. old cultures. However, the 4-5 day old culture in R. 21 survived 300 seconds of illumination. But of course we have to wait for further experiments in this area.

The resilience of the very young, 1/2 - 1 hour old cultures must be examined as a special question. B. in row 21 that if a certain amount of an old broth culture is transferred to sterile broth and then illuminated, which takes at least 1/2 hour to prepare the preparations etc., this mixture still behaves as a " ancient" culture in relation to killing time. So perhaps some clarity as to how rapidly the old bacteria rejuvenate by division might be obtained if one examined the period between 1/2 hr and 3 hr to see when and how rapidly the culture reached its peak Converted kill time to a low one. This must be reserved for future investigations.

If the great importance of age for hardiness is taken together with the two relations previously discussed, viz., that the number of the hardiest individuals is probably comparatively small, and that increasing degrees of hardiness as a whole are found in more and more decreasing numbers of individuals finds that the closer one gets to the kill line, one might perhaps allow oneself to assume that it is the oldest individuals that are the most resilient. If one were to imagine that in a culture at any given time there were a number of individuals who, for some reason, did not divide, but assumed a "sporoid" state, if you will, which became more and more pronounced with age , such individuals would have to appear in a manner similar to what I have found characteristic of the most resilient individuals. In a z. B. 12 h old culture, as we have seen, there are probably not only individuals with maximum resistance (ie 250-300 s kill time), but others, more numerous, whose kill time is around 200 s, others more numerous by 100s, while the vast majority, much like younger cultures, are killed in under 100s. Why very young individuals, say e.g. B. 1/2 hour old, should be distributed according to such a scale because they were born in an old culture, could only be explained by an artificial hypothesis, since they were born under exactly the same circumstances. But we should have a comparatively simple explanation if we assume the existence of the "sporoid" individuals under discussion of different ages, with correspondingly different hardiness. Such individuals should probably be distributed, in terms of number, on a scale such as that given, since the production of "sporoid" individuals would have to be in some proportion to the absolute number of individuals of which the culture existed at a given point in time.

This only as a suggestion to a hypothesis; should it find confirmation, it might be worth investigating whether other types of "exceptional cells" can be interpreted in a similar way.

Until further investigations are available, I will leave it up to you what this greater resistance of the older cultures is based on, since the current investigations are only complete insofar as they have discussed some of the most important conditions for obtaining constant test results, so why in the first place Consideration of the culture's age is required, at least when working with Prodigiosus. But whether other bacteria behave in a similar way, whether the chemical changes in the culture medium play any part, whether pigment formation is a contributing or perhaps even the only cause, whether there are really vital changes in the bacterial bodies, or more accessory conditions in the culture, such as e.g. B. the greater number of individuals pr. Unit volume, or perhaps simply clumping by some sort of agglutination in the older cultures, or finally, with age, a diminished permeability to the bactericidal rays, either of the bacterial body or of the nutrient medium—these are conditions which must be reserved for future investigations. But the experiments I have referred to here already give a hint to the solution of some of these questions; I will here e.g. B. name the following:

1. It is unlikely that a change in the chemical nature of the growth medium with the age of the culture is decisive for the hardiness acquired with age. Because in R. 21, R. 27 and R. 28 (cf. also R. 20, R. 29) only 0.04 cm, 0.96 cm3 and 0.02 cm3 of the old culture were transferred to 2.0 cm3 of sterile virgin broth Despite this strong dilution, the cultures that were illuminated as soon as possible behaved like old cultures.2 These same experiments also speak against the fact that the transparency of the nutrient medium, which decreases with age, is decisive.

3. The importance of pigment formation can be demonstrated most clearly by experiments with non-pigmented bacteria. There is no question that pigment formation is important for the very old cultures with a macroscopically clear pigment layer. But we see in the series of experiments numerous examples of the resistance being greatly increased at a time when neither macroscopically nor microscopically pigment can be detected in the cultures; but, of course, by these experiments I cannot definitely deny that some individuals have been protected by pigment.

4. That the cause is the increasing number of bacteria pr. unit of volume whereby some bacteria could shadow others is an obvious thought, and if the culture is highly clouded such will probably take place; but based on the following attempts, I don't think it mattered in my attempts:

In R. 20 we saw that the 1-2 month old culture, diluted so much in sterile broth that it was clear, was more difficult to kill than the 6 hour old culture, although this was already turbid.

From R. 21 it can be seen that it does not matter whether 1 or 25 bacteria pr. volume unit has.

In R. 27, 28, 29 the old cultures were so diluted as to be clear, while the younger cultures were turbid; nevertheless the latter were killed quicker than the former.

5. It would be an obvious thought to ascribe some importance to the greater resistance of the old cultures to the formation of clumps of clustered bacteria, which increased with the age of the culture.' In cultures more than 1 day old (R. 13, 14, 20, 21) such clumps are constantly found; in these cases, therefore, it is not likely that the lumps may have played any part. But in the experiments where the culture was 3-14 hours old, no clumps were found in the drops attached to the covering quartz when examined microscopically, either immediately after they had been deposited on the covering quartz, or

the day after Lighting; moreover, the regularity with which both the thinning out and the complete sterilization occurs rather speaks against the fact that the formation of lumps was decisive.

Whatever the reason for the resistance of the older cultures, it seems to me to be of biological interest that a Prodigiosus culture in the course of about 10 hours, e.g. B. in the course of one night, such resistance to the light is reached that it can endure 5-6 times more light than when it was 3 hours old.

The influence of temperature.

As several investigators (e.g. d'ARCY & HARDY, DOWNES & BLUNT, DUCLAUX, GAILLARD, KRUSE, LAURENT, MOMONT, RASPE, Roux, MARSHALL WARD, WESBROOK) have argued that the effect of light on the bacteria is based on an oxidation, it is obvious to investigate whether the effect of the light, like most other oxidation processes, does not increase with increasing temperature. As far as I know, there are incomplete studies on it. SAVERIO SANTORI is said to have found that sunlight acts less powerfully at lower temperatures than at higher ones. I do not know the original of his work, but since other of his results, as a result of a report, are in complete conflict with what we otherwise consider to be established, one cannot attach great importance to his work. KRUSE made a single series of experiments with typhoid broth cultures in test tubes, which he exposed to sunlight in flat dishes with water at approx. 0', approx. 16° and approx. 35°. From the experiment he believes he can conclude that the effect of sunlight increases with temperature. But, apart from the errors inherent in test-tube experiments in general (p. 7) and the small number of experiments, the results themselves do not seem to me very convincing. In fact, he found, by counting the colonies, that at 0° 2 hours' illumination was necessary to obtain the same degree of "attenuation" which was obtained at 160° by 1 hour's illumination and at 35° by 2 hours' illumination. From this one should think that the effect at 35° was weaker than at 169. KRUSE, however, means the opposite. He considers the light effect at 350 to be stronger than that at 169, because the culture at 35o initially grew more strongly than at the other temperatures, and was therefore weakened later. This latter reasoning is correct enough in itself, but the first conclusion is not compelling. It may be admitted that these experiments do not argue against a stronger light effect at higher temperatures, but the experiments at temperature 35o at least do not contain any proof of such an assumption .

My own experiments on the influence of temperature (in addition to always maintaining a constant temperature in the individual series of experiments) were made in such a way that drops taken from one and the same culture were exposed to the light at different temperatures of the water surrounding the preparations . From such attempts I have made the following.

Row 15 and R. 17, where no result was obtained because the kill limit was not reached.

R. 16 shows no noticeable difference between 200 and 30°, but the test series were chosen so poorly that there was a large lacuna at the crucial point (between 60 and 120 seconds).

It is true that R. 22 is not conclusive as to the time of mortification, because the judgment depends entirely on whether one wishes to regard No. 22 as an accident or not. But the "dilution" is much stronger at 350 than at 150

R. 23 gives the kill time for 180 between 100 and 110s, while for 360 it is between 90 and 100s. The difference is small, but it is accentuated by the fact that both the attenuation and the "dilution" are more pronounced at 360 than at 180. And although the culture, when illuminated at 36°, was "2 hours older , when the drops, which were illuminated at 18° and consequently, as we saw, had to become rather more resistant, it was nevertheless killed more rapidly.Finally, the result is supported by the fact that

R. 24 gives a very similar picture, only with the difference that while the cultures of R. 23 511-53St. were old, the culture is here

3 h and gets killed at 60-70 sec 360

50-60 Incidentally, the same reasoning applies here as for R. 23

R. 25, on the other hand, shows a completely opposite picture; but since the culture was infected with a foreign bacterium, one should probably not place much value on this series.

at 16.30

300

R. 31 compares the effect at 45° with that at 30°. Even if we are from No. Disregarding 12, which might be a "randomness", we get a faster effect at 45° than at 300. At 45°, the limit is between 20 and 40 seconds.

40

60 Furthermore, the "dilution" is much greater at 45" than at 30°, and while growth at 30° is diffuse (+), at 45° it is "scattered" (s) (cf. p. 81).

R. 32 gives corresponding results:

At 45° the limit is between 20 and 40 seconds.

40 60

15"

bo

90

Again, the "dilution" is greatest at 45".

R. 34 simultaneously examines a 5-6 hour old and an 8-9 hour old culture at different temperatures.

5-6 hours old culture:

At 45° the limit is between 40 and 60 seconds.

60 100

300

30°

300

8-9 h old culture:

At 45° the limit is between 60 and 100 seconds.

100 150

15"

100 150 Here, too, we see the thinning occurring earlier and stronger everywhere, the higher the temperature.

Since in the last three series of experiments, which, incidentally, are those just discussed, which are carried out with the most precautionary measures, one always begins with the highest temperature and investigates the lowest last, one could theoretically object that if the last illuminated Bacteria in each row were the most resistant, this fact could in it

This is because by the time the first ones were illuminated they had become about an hour older, in other words that the result was a consequence of age and not temperature. Although a comparison with the corresponding ages on Plates I and II (pp. 87-88) will immediately convince you that in any case the effect of 45o cannot be explained in this way, I have made some direct attempts to prove the justification of this objection to investigate, namely:

R. 36, where the experiments at the low temperature were made before those at the high temperature. It turned out that the kill limit for one culture at 15o (age 4 hours) was between 70 and 100 seconds 4.20 ,

30 50

20 The latter two intervals (20--40 and 30-50) do mesh, but at 30' all 4 drops gave growth after 30 s, while at 45° 3 drops out of 4 were sterilized after 20 s. The kill limit was for the second culture

at 150 (age 9 h) > 170 sec

300

9.20 ,

> 170

450 9.40 , between 80-100 sec.

In this series of experiments, too, the dilution was greater

300 450

4.40 »

40

at 459

0

There can be no doubt from these experimental results that Prodigiosus is more readily killed by the light at 45° than at 30°, and from R. 23 and 24 it is probable that he is more readily killed at 35° than at 16-189. On the other hand, whether there is a difference between illumination at 30' and 150 remains doubtful. Although the rows 32, 34, 36 speak in favor of a greater effect at 300 than at 15°, but when compiling the remaining VerFinsen, medical light institute. II

series of searches, the picture becomes so blurred that it is not possible to say anything about it for the time being. You can e.g. B. after these experiments do not rule out the possibility that there is an "optimal" lying somewhere between 150 and 300.

This influence of temperature is of interest from two different points of view. First in biological terms. As the control experiments (R. 35) unanimously testify, Prodigiosus suffers no visible damage when exposed to a temperature of 45' for as short a time as my experiments lasted; nevertheless, at this temperature he is more quickly killed by the light. At the moment I don't know whether increased oxidation is to blame.

Second, these ratios could possibly acquire practical significance. If later experiments show that pathogenic bacteria behave in a similar way, care should be taken during light therapy not to cool the affected area of skin more than is necessary so that the patient is not bothered by the heat rays.

from

Although I do not expect that other researchers will find exactly the same absolute values as I did in the above experiments, because so many other factors, some of which are still unknown, can become important in the living conditions of the bacteria, I believe that it is not without importance is to be able to draw up certain figures that apply under certain conditions. I have found, therefore, that under the influence of light, which is 28 cm. from an electric arc of 35 amperes and 50 volts, at an angle of 45° with the axis of the coals, after part of the heat rays have been retained through a 25 mm layer of water between quartz plates, and at a temperature of 30, a 3 hour old Prodigiosus broth culture in hanging drops is sterilized in about one minute, a 10-15 hour old culture only in 3-5 minutes. At 45° the light acts faster than at 30°, so that a 3-hour-old culture is sterilized in about 1/2 minute two factors together can cause the kill time to be ten times as long in one case as in another.

Copenhagen, November 1899.

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II.

The actinoscope

from

Absalon Larsen.

As is well known, the light-collecting devices of the Light Institute are provided with rock-crystal lenses and combined with a layer of water that absorbs the heat rays.

The institute has now given me the task of constructing an apparatus with the help of which it can be easily and quickly determined whether the light concentrated by the collecting apparatus contains ultraviolet rays or whether they contain ultraviolet rays, which should not be the case with good apparatus , have been absorbed. I have called the apparatus constructed for this use the actinoscope. The basis of the apparatus is the phenomenon observed by Hertz') that ultraviolet rays promote the formation of electrical sparks. Will e.g. If, for example, sparks are formed between a platinum plate and a small brass ball by means of a small RUHMKORFF inductor, the electrodes can be separated considerably further without the sparks ceasing if the platinum plate serving as the negative electrode is irradiated with ultraviolet rays than if this were the case is not the case.

A drying element and a RUHMKORFF inductor are in a wooden box (24x26x26 cm). the

a

Electrodes are in a smaller wooden box (8x8x17 cm) (Fig. 1). The electrodes a and b are connected to the secondary windings of the inductor by means of well-insulated leads.

For convenience, the main current is passed through a breaker, not shown in the figure, attached to the small box. The negative electrode a consists of a platinum-coated brass plate with a diameter of 2 cm. The positive electrode is a brass rod b which can be removed from or approached to the platinum-coated plate by means of a hard rubber screw-head e. The light enters through the opening, 0, and hits the platinum-coated plate.

b The experiment becomes as follows

Fig. 5. Moderately employed: The small box is held in the hand in such a way that the platinum plate is in shadow. The main flow is closed and the brass rod is first brought so close to the platinum plate that sparks appear and then turned back a little so that the sparks stop. The box is then held in such a way that the rays to be examined coming from the collecting apparatus strike the platinum plate through the

opening o. Now, if ultra-violet rays are present, lively sparks will arise instantaneously, and cease just as quickly if the platinum plate is placed in the shade, or if even a very thin plate of glass is held in front of the opening. As a precautionary measure, it is checked whether the unconcentrated rays coming directly from the arc lamp can produce sparks

It is never difficult to decide whether the rays are working or not. The sound of the sparks is quite specific if there are ultraviolet rays The whole thing goes

so easy and so fast that 10 collecting apparatuses can be checked with the actinoscope in less than 10 minutes.

The collection devices of the institute were checked with the actinoscope. Any errors that were present were mostly due to contamination of the water layer. In two cases it was stated that the hydrochloric acid used to clean the collection apparatus had not been flushed away with sufficient care.

In other cases, the contamination absorbing the ultraviolet rays came from the putty used to fix the lenses. In all cases the apparatuses were put in order after being rinsed and filled with fresh distilled water. Ordinary water absorbs the rays acting on the actinoscope.

As can be seen, the actinoscope can be useful in some cases, although it gives only qualitative and not quantitative results. The rays acting on the actinoscope are located fairly far into the ultraviolet region, as can be seen from the fact that they are absorbed not only by glass, but also by very dilute hydrochloric acid, by insignificant inorganic impurities, and by ordinary water.

Since almost all substances that absorb ultraviolet rays cut off only those rays lying furthest in the ultraviolet spectral range in small quantities and only absorb rays lying closer to the visible spectrum in larger quantities, the actinoscope test may be regarded as a strict test . When the rays act on the actinoscope, it is safe to assume that the collecting apparatuses are fine as far as absorption is concerned.

About the phenomenon discovered by HERTZ, which comes into practical use here, refer to the comprehensive ones investigations by WIEDEMANN and EBERT!). From these it appears that the phenomenon is complicated and varied, according to the form and nature of the electrodes, and the nature and pressure of the air. In particular, it should be noted that irradiation not only increases the length of the spark, but also completely changes the character of the discharge.

While working with the actinoscope I noticed a special circumstance which, to my knowledge, had not been observed before. It is found that, under the action of the direct rays of an arc lamp, the discharge takes place most vividly at a certain distance from the lamp, ceasing when the apparatus is far removed from the lamp, as well as when it is quite near lamp is approached.

In the latter case the sparks reappear either when a screen provided with a small opening, or a sheet of water, is held in front of the lamp. In contrast, light concentrated on the platinum plate by a rock-crystal lens appeared very powerful. However, at the moment when this communication is being written, I have not had the opportunity to investigate the phenomenon mentioned more closely.

It should also be noted that the action of ultraviolet rays on the electric discharge has recently been used for telegraphing 2).

1 Annals of Physics and Chemistry 33, p. 241 and 35 p. 209, 1888. 2) Electrotechnical Journal 19, p. 414, 481, 826, 1898.

III.

A photometer.

from

Absalon Larsen.

To measure the intensity of the concentrated light I constructed the apparatus described below.

A few broken rock-crystal lenses were crushed into fine sand, which was slurried in water. What remained suspended after the lapse of a few minutes was dried and then formed a very fine white powder. This powder was pressed between two rock crystal plates set in a brass ring. The whole now formed a milk-colored plate, which was fastened through a circular opening in one side of a square, matte-black interior, paneled wooden box, shown in Fig. I. a is the milk-colored rock-crystal plate, b, b are two screens with openings of the same size as the plate. A freshly prepared piece of silver chloride paper is fastened to the side of the box opposite the plate (which can be opened). Plate a, temporarily closed with a lid not shown in the figure, is placed where the light is concentrated , and the cover is taken off on it.After

c

After a certain time, measured with a chronograph, after about 3 minutes, the lid is put back in front of the opening. The silver chloride paper was then blackened, and the intensity of the light can be determined from the degree of blackening of the paper, as described below. By using the rock-crystal plate described, the light is so weakened that the time required to produce a suitable blackness becomes so great that it can be accurately measured, while the paper is blackened in a very short time by direct irradiation with concentrated light. On the other hand, the weakening of the light

b not associated with absorption of ultraviolet radiation, which would be the case if one had used an ordinary frosted glass plate. the

Fig. 6. The effect of the fine rock crystal powder on the light must be understood in such a way that the rays striking the powder, after numerous reflections and refractions, leave the powder in all directions as diffuse light, so that the plate can be regarded as a new light source can. The presence of ultra-violet rays in the diffuse light emanating from the rock-crystal plate under the circumstances mentioned has been ascertained with the actinoscope described above.

The use of photographic paper to measure the chemical intensity of light is a very common method, e.g. B. has been used by ROSCOE and WIESNER (see the communications of the Institute I, p. 109, 1900). Said researchers compared the color of the surface Finsen, Medical Light Institute. II.

of the paper with appropriate spot colors. However, there is no simple relationship between the surface color and the amount of light. It must therefore be determined by preliminary tests what amount of light corresponds to each of the standard colors, and care must always be taken afterwards that the blackening of the paper is the same as that of a standard color, since the eye cannot quantitatively estimate color differences. I have therefore renounced the use of normal colors and, following the advice of Dr. Following Bang, devised a new procedure, which consists in looking at the blackened paper in a continuous light. Let's imagine a piece of exposed paper whose degree of darkness is to be determined.

Now if this paper is placed close to an unexposed piece of the same type of paper and

If the two pieces are exposed to the same intensity from behind in the dark room, with light intensity 1, then they will not appear equally bright when viewed from the front.

In Figure 7, a represents the non-blackened Fig. 7.

and b the blackened paper. by Ver

By strengthening the light falling on the back of the paper / it is possible to make b appear just as bright as a. If the necessary light intensity z. B. 4, while the paper a is exposed as before with the light intensity i, then I will set the degree of blackness of the paper b equal to 3; for if the paper b had not been blackened, then the luminous intensity i would be sufficient to make b appear as bright as a; now the light intensity 4 is necessary for this; the luminous intensity 3 was then held back by the silver particles separated out in the paper. Experiments have shown that the degree of blackening determined in this way at least up to degree of blackening 2

a

is proportional to the amount of light that caused the blackening. It is therefore more rational to look at the paper in a solid light than to judge the surface color, and the difficult use of solid colors can be dispensed with.

The measurements are carried out with the apparatus shown in FIG. C is a double prism according to LUMMER and '

BRODHUN), your magnifying glass. The double prism is ground in such a way that A can be seen through a certain section of the interface of the two halves, and consequently the piece of paper a

B

ib considered while at all

C total reflection takes place at other points of the contact surface, that

D sees the piece of paper b there. a and b become with two

Fig. 8. Incandescent lamps A and B, which can be moved on two rails marked with graduations, exposed. As it cannot be assumed that the two incandescent lamps have exactly the same intensity of light, the experiment is made in the following manner. B is at a certain distance, z. B. 100 cm, from the unblackened piece of paper b, and A is shifted until the two fields seen in the prism appear equally bright. Now the blackened piece of paper to be measured is used in place of b. To restore equality of

man

ver

1) Journal for Instrumentation 1892, page 41.

To get two fields, one has to move B closer to the prism, say up to a distance of 50 cm. The light

100 intensity of the light falling on b is now í

four times

50 larger than before; the degree of blackening is therefore 3. The luminous intensity of incandescent lamps varies considerably with the operating voltage. However, this is of no importance if the two lamps are the same and are fed by the same line. For the sake of convenience, the first adjustment is always made at one and the same distance. A table calculated once and for all then gives the degree of blackening corresponding to the second setting. The quotient of the exposure time in minutes and the degree of blackening gives the luminous intensity. If the degree of blackening of several pieces is to be determined, you only need to undertake the first adjustment once.

The setting can easily achieve an accuracy of '2 percent with practice. The difficulty of the method lies in the fact that it is not easy to always have paper of the same sensitivity. But the same difficulty is inherent in the older methods. I have always used Rive's base paper and prepared the same myself. Pieces the size of a quarter sheet are placed in a 3% solution of NaCl for 5 minutes and then hung up vertically to dry. After drying, the lower part of the paper, which contains more NaCl than the rest, is cut away. The paper thus salted is placed in a 10 per cent solution of $AgNO_3$ for 3 minutes one day before use, and then rinsed three times in pure water for one minute each time, after which it is hung up to dry in the dark room.

a

The method described here for determining the degree of blackening of photographic paper has been used, among other things, to measure the absorption taking place in agar and broth. Furthermore, the same method has been used to determine the dependence of the photochemical intensity of the arc light on the current and the voltage, as will be shown below.

September 14, 1899.

IV

The dependence of the electric arc light on the current strength

and the tension

from

Absalon Larsen.

In order to get an idea of the nature and magnitude of the changes in the electric arc light associated with changes in current and voltage, I have made some measurements of the intensity of the light, some with bolometers and some with photographic paper. In front of the bolometer was a glass plate for the absorption of heat rays, so that the bolometer measurements give approximately the total amount of energy of the visible rays converted into heat, while the measurements with photographic papers, the degree of blackening of which was determined in the manner described above, indicate

, approximately a measure of the intensity of the violet rays.

The numbers given under "Bolometer" in the table below are converted to indicate how many gram calories per second the rays falling on the bolometer would develop in the bolometer if the bolometer was 1 meter from the crater and the surface of the crater bolometer was one square meter. The under "Phot. Paper” are calculated from the degree of blackening as follows: The degree of blackening, which was between 0.5 and 1 in all tests, is divided by the exposure time in minutes and multiplied by the square of the distance from the crater expressed in meters. The resulting numbers, which correspond to an exposure time of

1 minute and a degree of blackness corresponding to a distance of 1 meter have been multiplied by 100 so that they could emerge as whole numbers.

I have examined the light from a small hand-regulated lamp with 14 mm and 11 mm diameter carbons and that from a large self-regulating shunt lamp with 24 mm and 15 mm diameter carbons. In all experiments the rays used formed an angle of 45° with the axis of the carbons, and both the bolometer face and the paper were placed perpendicular to the rays.

*) Average from three series of measurements.

The dependence of the light intensity on the voltage has only been examined with the hand lamp. At 40 volts, both the thermal effect and the photochemical effect are significantly smaller than at the other voltages. Between 40 and 60 volts are both considered independent of voltage

regard; but already at a voltage of 60 volts the lamp no longer burns smoothly, and various ver

tests at this voltage vary considerably.

Two series of tests were carried out with both lamps at a voltage of 50 volts on the dependence of the light intensity on the current strength. The test results are graphically represented by FIGS. 1 and 2. The observations are marked by small circles. Curves are inserted between the observations. In Fig. 1 (the hand lamp) the deviations between the observations and the curve are on the whole small, from which it can be seen that the lamp burned steadily. Larger deviations occur in FIG. These are mainly due to the irregularities that arise each time the regulator works, at least when, as in my experiments, the tension regulation is left to the automatic regulator alone.

The thermal effect of the hand lamp is proportional to the amperage, that of the shunt lamp only approximately. In both cases, however, the photochemical intensity increases much faster than the current. In other words, as current is increased in a given lamp, the intensity of the violet end of the spectrum increases much faster than that of the red end. For the hand lamp z. For example, at 8 amps the ratio between the numbers expressing the photochemical intensity and the heat effect is 2, while at 16 amps the ratio is 4. For the large lamp the ratio is 2.7 at 24 amps and 5.7 at 48 amps.

A comparison of the two lamps with one another is best carried out with current strengths which behave like the cross-sections of the positive carbons. At 12 amps the small lamp gives the thermal effect 16 and the photochemical effect 49. The large lamp, whose positive carbon has three times the cross-section, gives at 36 amps the heat effect 56 and the photochemical effect 198. The ratio of the current intensities is 3, the ratio of the thermal effects is 3.5, and the ratio of the photochemical effects is 4. With the same current density, therefore, a large lamp is a little more economical than a small one, and the light of a large lamp is a little more developed in the violet region of the spectrum than that of a small one.

It is not difficult to see that the results must go in this direction, for an increase in the current density and a simultaneous increase in the cross-section of the carbon must give a larger crater and a higher temperature, again causing an increased emission and a shift towards the violet The experiments reported here can only be regarded as indicative. For an exhaustive investigation, spectral apparatus would be necessary, with the help of which the intensity of the radiation could be measured in all spectral regions.

September 27, 1899.

The light as an incentive

from

Prof. Dr. Nils R Finsen.

This treatise is not reproduced in the German edition as it previously appeared in Prof. Finsen's book: "On the Significance of the Chemical Rays of Light for Medicine and Biology".

Lupus vulgaris laryngeal.

A clinical investigation

from

Prof. Dr. Holger Mygind.

This paper is not reproduced in the German edition as it previously appeared in the Archiv für Laryngologie, Vol. X.

Report from Finsen's medicinske Lysinstitut.

From January 1st to December 31st, 1899. The following annual report is of only local interest in many respects, but is reproduced here partly for the sake of completeness, partly because it gives some explanations about the course of development of the Light Institute.

I

By Prof. Dr. Niels R Finsen.

space

The institute's first annual report covered the period

from August 1896 to December 31, 1897. The current annual report covers the two years from January 1, 1898 to December 31, 1899.

I can begin this annual report, like the previous one, with the fact that I am not reporting on quiet, steady activity here, but on one that is in constant and rapid development, which is far from having come to a rest.

The Institute's work on the subject of light (the proof of the use of light in medicine and efforts to gain recognition in the medical world) has grown steadily, and especially over the past year the practical work, i.e. the treatment of patients, has had a preliminary The culmination was already reached at the end of 1898, since the limited space did not allow any further increase in the number of patients, so that there was no other advice than to turn away a large number of patients for the time being. At a certain time of the year the number of registered patients was well over 100. We tried to remedy this inconvenience by treating the most needy patients first, and there was a reasonable prospect of expanding the institute to such an extent that all legitimate claims could be expected are to be satisfied. This was made possible by the large subsidy of 240,000 crowns, which was granted to the institute as an interest-free loan in accordance with the finance laws of 1899-1900, and by the acquisition of the property in the villa district "Rosenvaenget", already mentioned in the previous annual report, which was finally made possible in every respect, both by its buildings and by its ground area, is excellently suited to the institute.

While the future of the Light Institute seems to be well secured in economic and material terms, it was important to me at the same time to provide the institute with the greatest possible security through a strong internal organization, especially as far as the intellectual forces are concerned.

Since it is dangerous for any institution to depend exclusively on one person, I tried to avoid this with the Light Institute by giving each department of the institute, the laboratory and the clinic, a completely independent and responsible manager. The direction of the laboratory has been taken over by my colleague and friend of many years, DR. SOPIIUS BANG1), whose scientific aptitude and critical talent will be of the greatest importance to the Light Institute, and whose task in the years to come will be to direct the scientific-physiological investigations in the field of light.

Dr. HOLGER FORCH was put in charge of the clinic

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dr BANG is currently an assistant doctor at the municipal hospital and will therefore only be fully at the service of the Light Institute in 112 years.

HAMMER, who joined in February 1898, was appointed Senior Physician at the end of 1899, whose talent for administration and practical ability have brought the institute a great deal of benefit under often difficult circumstances.

In this way the laboratory and the clinic, which were initially united, have been completely separated, but I hope that the separation will above all benefit and not harm. Since the two departments will be located next to each other on the same property, and since the head of the institute will form a link between the two, the conditions for the necessary collaboration will be favorable. On the other hand, the field of work for both departments is so large and so different that the separation was absolutely necessary.

As in the past, the Institute has had numerous visits from doctors, some Danish, some foreign. Great importance must be attached to visits by foreign doctors, as an excellent means of spreading interest in light therapy; for while the Light Institute and Light Treatment have long enjoyed the greatest recognition on the part of Danish and Scandinavian doctors, the same could not be expected from foreign doctors. In fact, one cannot be surprised that the medical world received reports of the remarkable effects which chemical rays possess with a certain distrust, whether, as with smallpox, they were harmful, partly, as with smallpox lupus, are useful. The fact that these things also appeared in a small country, remote from the great center of science, and originally in a language known only to a few, was of importance that should not be underestimated.

The visits of foreign doctors were of two kinds: partly doctors who were passing Copenhagen and thus taking the opportunity to see the Light Institute, partly such doctors, mainly dermatologists, came purely for the sake of the matter itself. These latter stayed for a short, or a longer time, in order to study the method thoroughly. In this way we have had the honor and pleasure of receiving several of the greatest and most well-known dermatologists in Europe.

A complete listing of the places where the method was introduced and applied is not easy to give, but you can only get an approximate overview by looking through the list of places to which the manufacturer of the institute sent the light-collecting apparatus. The numbers in parentheses after the city name mean that that number of machines was delivered to doctors or hospitals. Athens

Los Angeles (3)

Baltimore

Moscow

London (2)

Munich

Wroclaw

new York

Budapest

Paris (2)

Dortmund

St Petersburg (4)

Hamburg (3)

Washington

Cairo

Vienna (4)

Cologne

1) In the course of 1899 there was a change in the sale of the light-gathering apparatus, as the firm WA Schiörring, Reventlowsgade 10, received a trademark of the apparatus in my name in most countries. The exclusive sale of the same is the same as-'. transferred to the company mentioned, while the apparatus, as before, is manufactured by Mr. Warberg the plumber. All devices are tested in the Institute's laboratory before shipment.

ʅ

The great interest and favor shown to the institute and to the light cause by members of the Danish royal family have been of the greatest importance in the spread of light treatment and its penetration into certain other countries of Europe. In January 1898 we had the honor of visiting HRH the Crown Prince for the first time, and later he showed the greatest interest in the Light Institute, its work and its patients. Since that time, the Light Institute has had the honor of being visited by royalty and their imperial and royal guests on a number of occasions. . These visits meant that light treatment was introduced to the three countries of Greece, England and Russia earlier and in a better way than would otherwise have been the case. IM Queen Olga of Greece has donated solar treatment apparatus to the Evangelismos Hospital in Athens and has also had a Danish nurse trained at the Light Institute. IKH the

Princess of Wales donated to the great "London Hospital" a complete set of equipment for treatment with sunlight and electric light, as a result of which the chief physician of the same dermatological department, DR. STEPHEN MACKENZIE, came to Copenhagen to teach the method for about a week to study. Two nurses were later sent here from the hospital, who went through a one-month course.

IM the Dowager Empress Maria Feodorovna of Russia introduced the method there and made the Russians acquainted with it in the best possible way. Her Majesty wished to set up an institute in St. Petersburg entirely on the pattern of the institute here, and made available all means so that both a scientific department

to

from

(Laboratory when a clinic was established. To convince the medical world in Russia of the importance of the matter, Her Majesty sent the surgeon, Prof. WELIAMINOFF, with his assistant, DR. SERAPINE (who now directs the Light Institute in St. Petersburg , assisted by a Danish nurse) came here to study the method. Furthermore, the Empress summoned Prince Oldenburg (the supreme chief of Russian medicine) to Copenhagen, together with three Russian scholars, Prof. LUKIANOV, Director of the Imperial Pathological Institute in St Petersburg, TCHISTOWITCH, Professor of Infectious Diseases at the Imperial Military Medical Academy, and DR.

As a result of these visits, a series of medical lectures on the light method were given in St. Petersburg, some with demonstrations of slides from photographs of the local institute; also several treatises were written on the matter. The Light Method was introduced in Russia in this excellent manner, and consequently in no other country in Europe, outside of Scandinavia, is it so well known and recognized as in Russia.

II.

The Laboratory

from

dr Sophia Bang.

Compared to all previous attempts to use the properties of light to cure diseases, the effectiveness is increasing

Light institutes a Finsen, medical light institute. II.

our

A special position based primarily on the fact that the institute's plan and mode of action are based on scientific work. Based on scientifically based theories, FINSEN began to use light for curative purposes; no less was the manner in which it was applied, even in the first uncertain attempts, based on physical and physiological experiments. Otherwise the Light Institute, even with the most successful cures, would not have achieved the leading position which it now indisputably occupies in the field of light therapy. Proceeding from this, there has arisen throughout Europe an ever-growing interest in both scientific and practical experiments with the light, a movement through which the mother institute of our country is perhaps in danger of being overshadowed by the institutes which are already flourishing in many large cities. Of course, the Light Institute has so much basic experience at the moment that it has a good head start; whether it will succeed in maintaining the lead in the future will depend on whether it will also be able to assert its superiority in scientific terms. Fortunately, the importance of this matter was clear to the leaders of the institute from the beginning, as can be seen from the first paragraph of the statutes: "The task of the institute is to undertake and promote investigations into the effects of light on living organisms. Um To promote these investigations, the institute was divided, as soon as general status permitted, into an experimental laboratory department and a clinic, each with its own director, and ample funds have been made available to the laboratory by the directorate of the institute.

A fairly significant body of research is already made in the laboratory; Apart from the results already published, however, there was a great deal of preliminary work to be done, to an extent of which one could have had no idea in advance. Although so much has already been written about the effects of light on the animal organism and on bacteria, one often had to work on soil that had hitherto been completely uncultivated; only a fraction of the earlier work is carried out in such a way that the results could be relied upon. Almost every question had to be recorded from scratch; not only how to create a light with the desired properties, but also how it should be regulated, controlled and measured; what properties the light used had, and what sources of error were inherent in its use - a great deal of such technical detail had to be investigated before anything could be known of the effects of light. And although we now have much more insight into these circumstances than we did a few years ago, in many respects we are still aware that we are at the very beginning: everything we have published so far is only to be regarded as preliminary work.

We can name some of the larger unpublished works that have occupied us over the last two years: investigations into the influence of light on the metabolism, with the development of new methods for determining the same. The action of light on tubercle bacilli investigated by means of animal experiments. The effect of concentrated light on living tissues. The influence of light on food substrates. Smaller works can be mentioned: The construction of electrical resistors, particularly suitable for experimental use. Attempts to increase the contents of the arc light to chemical rays. light measurements. Investigations about the

Functionality of the devices used in the clinic. Checking the devices that are ordered for abroad. Microscopic examinations for the clinic. Various bacteriological works.

The clinic

from

Holger Forchhammer.

In the years 1898 and 1899, as in previous years, the work at the clinic consisted predominantly in the treatment of lupus vulgaris, while the influx of patients with this disease was constantly increasing.

In addition, as space has permitted, attempts have been made to treat other skin diseases, among which, in the first place, should be mentioned lupus erythematosus, alopecia areata, epithelioma cutaneum, acne vulgaris, acne rosacea and nevus vascularis planus.

After the number of light apparatuses had increased from 8 to 16 in November 1897, the number of patients rose very quickly. While in December 1897 the daily number of single treatments was under 50, by April 1898 it had reached 100. A further rise was made possible by the installation of four new light apparatuses in October 1898. For the whole year 1898 the average number of single treatments pr. Day 99 off, for 1899 the number was 126.

The number of newly admitted patients was in 1898: 219, in 1899: 289.

Also, of those who arrived in 1896-97

Patients 88 have been here for continued or renewed treatment,

that the total number of patients treated in 1898-99 is 596.

Lupus vulgaris: a total of 454 patients were treated, 73 of whom were transferred in 1896-97, 162 were added in 1898, 219 were added in 1899.

Of the 381 newcomers were: the male sex 1898: 42, 1899: 56, in all: 98 the female sex

120, 163,

283

40-60

The age of the patients was: 0-15 years

1898: 15, 1899: 26, in all: 41 15--25

64, 66,

130 25-40

52,

72,

124

23,

48,

71 60-70

8th,

7

15 In 1898: 155 were from Denmark, in 1899: 187, in total: 342 were from abroad

7,

32,

39 Of the Danes were: from Copenhagen

1898: 33, 1899: 31, in total: 64 the rest of Zealand

18,

26

44 Jutland

81, IOI,

182 Funen

12,

14,

26 the other islands.

15,

26

22

..

.

The foreigners were: from Schleswig.

1898: 3, 1899: 9, altogether: 12 rest of Germany

I

I

2 Sweden

3,

6,

9 Norway

7,

7 Russia

3,

3 Finland

2 UK

3,

3 France

I

I

.

The duration of the disease of the patients before the treatment was as follows: 0-5 years

1898: 34, 1899: 67, in all: 101 5-10

45,
50,

95 10-15

34,
45,

79 15-20

21,
21,

45 20-25

13,
20,

33 25--30

6,

II 30-35

3,

5,

8 35-40

I

4,

5 2,

4

5.

9

over 40

2,

Of all 454 patients treated for lupus vulgaris, at the end of 1899 121 were still under constant treatment, 307 had finished the main treatment, while 26 had broken off the treatment at the wrong time.

Of the 26 who discontinued treatment, 10 had died (7 from tubercul. pulm., 1 from ulcus cancrosum in lupo, 1 from Morbus cordis pp, 1 after a laparotomy), 5 had a hearing loss because of tubercul. pulp. gravis, 5 had to leave because of private circumstances not affecting the treatment, 4 left us to continue the light treatment at home, finally 2 stayed away without giving a reason.

While in previous years lupus patients had been treated exclusively with light, in 1898-99 we used various other treatments as preparatory or adjuvant in some cases. So in some cases we performed excavation or thermocautery. More common are caustic ointments, usually Ungv. ac. pyrogallici comp. (BESNJER) applied. During the light treatment almost all patients wore a protective dressing, either a poultice of boric acid or an inert ointment dressing.

The numerous mucosal localizations, most of which were not accessible to light treatment, required special treatment. Prof. HOLGER MYGIND has rendered the institute the service of examining 200 of the patients and has graciously taken over the treatment of the cases of lupus laryngis that have arisen.

The frequently occurring eye disorders are kindly treated at the eye disease clinic of the commune hospital Dr. medical EJLER HANSEN and Dr. medical B.C. F. BENZEN).

Other complications often required special treatment, and the Institute's physicians have now and then supervised the patients at home, and we have also exercised some supervision over the larger and smaller boarding schools which have been specially set up for the Institute's patients.

Erysipelas and erysipelas-like cases have occasionally occurred, but only as isolated cases.

No diseases have become epidemic among the patients.

As before, Prof. HASLUND has kindly helped to make the diagnosis in doubtful cases.

Finally, it must be mentioned that some of the institute's lupus patients were benevolently referred to adm. JOHAN FISCHER, partly in the community hospitals, partly in his private clinic.

Other diseases: In the years 1898-99 a total of 142 patients with other diseases were treated. Of these, 15 are transferred from 1896-97, in 1898 57 arrived and in 1899 70 arrived.

I. Lupus erythematosus: 31 patients in total, 27 from Denmark, 2 from Russia, I from Norway and 1 from Sweden.

Of the patients, 7 were men, 24 were women, all over 25 years of age.

At the end of the year II were apparently cured, 10 were still on treatment, while 10 had discontinued treatment without result. Of these latter, one died, the very widespread affliction greatly increasing, one markedly aggravated by treatment, the rest being but little affected.

The majority of patients have been treated exclusively with light, some have been treated concurrently by other means, most commonly superficial galvano-cautery.

2. Alopecia areata: 29 patients in total, all from Denmark. The male gender 18, the female gender &

Age: 0--15 Years: 8

15--25

9

25-40

8 40-60

4 At the end of the year 22 were healed, I was still under treatment, while 6 had broken off without result, most after treatment for only a few séances.

Almost all patients were also treated with antiseptic bath water during the light treatment.

3. Epithelioma cutaneum: 17 patients in total, all from Denmark. Male gender 7, female gender 10. Age: 25-40 years: I

7 60-80

40-60

By the end of the year 8 were apparently cured, 2 were in marked improvement, and 7 had discontinued treatment. Of these, one had been treated for a long time under the diagnosis of lupus vulgaris. The large cancerous ulceration recovered and the condition quickly deteriorated again. One improved but died of an intercurrent condition. One was treated solaminis causa for a large ulcus faciei.

4. Acne vulgaris and acne rosacea: in total 15 patients, of which 14 were from Denmark, 1 from Norway. The male gender 8, the female gender 7.

Age: 14-25 years: 6

25--40

5

40-60

4 At the end of the year 4 were apparently cured, 5 much better, 1 still under treatment, while 5 had discontinued treatment without result.

5. Naevus vascularis planus: 10 patients in all, 9 of whom were from Denmark, 1 from Norway. The male sex 3. The female sex 7.

Age: 0-15 Years: 4

15-25

3

25-40

3 By the end of the year, 1 was apparently cured, 2 had discontinued treatment, 7 were still on treatment

6. Tuberculosis cutanea: 7 patients in all: 1 Ulcus tubercul. anguli oris, still under treatment; 3 cases of tuberc. cut. verrucosa, of which 2 had healed, the third closed without result; 3 cases of "Gommes scrophuleuses" not noticeably affected by light treatment.

7. Trichophytia capitis: a total of 6 patients, all children under 7 years of age.

The result was negative in 4 cases; in 2 cases, both fresh and little spread, recovery occurred.

8. Favus, 2 cases, both with negative results.

9. Seborrhoea capitis, 4 cases, all with negative results.

10. Eczema faciei et sycosis, 5 cases, all with negative results.

11. Ulcera luetica, 5 cases. The 2 cases some time . who were treated under a wrong diagnosis apparently improved, the 3 other cases were only treated for a short time and mainly out of social considerations.

12. Keloid after vaccination, i case in a child of 7 years old; treated with negative results.

13. Pigment atrophy, 2 cases, with negative results.

14. Various, 8 cases in all, of other diseases where the treatment was not fully carried out. Including a case of otitis chron. and a case of tuberculosis vesicae urinariae, treated by means of apparatus specially constructed for the purpose, both without clear result.

VI.

investigations
About the frequency ratio of

Lupus vulgaris in Denmark

from

Prof. Dr. NR Finsen.

Because of the large and constant flow of lupus patients to the Light Institute, it would be advantageous for practical reasons to know to some extent the number of local lupus patients, so we have undertaken to provide some information on this.

In view of the scientific interest that such an investigation would have, we first wanted to make it reasonably comprehensive; but it soon became apparent to me that the difficulties were so great, and the chances of obtaining a reliable result so slim (a matter which I shall prove below), that I determined not to investigate more extensively than it did is necessary for our practical purpose.

There were two ways to get information about the number of local lupus patients: an inquiry to all doctors or to all pastors. If one chose the first route, the result was bound to be very erroneous, for the fact is that most lupus patients with long-standing lupus no longer seek medical attention for their illness and are therefore not known by doctors. If the doctors had a certain topographical sphere of activity and knew everyone in this sphere, the relationship would be quite different. The latter is more applicable to pastors, but here, on the other hand, there is the inconvenience of not being able to rely on the diagnosis. In order to get scientific, useful statistics, the pastors and doctors would have to work together so that the pastors find the sick and the doctors make the diagnosis. But this question was not of such great importance to me that I should therefore initiate such a great work and cause so many people inconveniences. On the other hand, it was worth trying to carry out this combined method of investigation in a limited number of pastorates, and then to be content with it and to draw a conclusion about the situation in the whole country from the ratio obtained.

It so fortunately happened that some time before the Light Institute had had the visit of a large crowd of pastors from different parts of the country who had come to Copenhagen for other reasons. Hoping that their visit had interested them in the matter and that they would therefore do careful research, we sent these pastors, as well as many personally known ones, in all to 70 pastors') a form to fill out, in which the following Questions were asked: 1) How many patients (names, ages) suffering from facial lupus are in the pastorate? 2) Was the diagnosis made by a doctor?

65 pastors answered these questions and the result was the following: In 31 pastorates there was no lupus

on

I) We chose almost exclusively pastors from rural pastorates, since these probably knew all the inhabitants of the pastorates much better than the pastors from the cities.

patients, in the remaining 34 were 54 patients, and these were distributed as follows:

in 2 pastorates 4 patients

In all cases except two, the diagnosis had been made by a physician. All of the replies, for which I offer my sincere thanks, showed that the pastors had gone to great lengths to obtain accurate information, and in many cases they had worked with doctors to find patients.

These investigations were made in March-April 1899.

Since I would like to have an expert opinion as to the value that could be attached to these investigations, I turned to the State Bureau of Statistics, and Director Rubin took up this question with the greatest kindness, and had the information obtained examined and sent me the following statement of the result, with permission to use the same:

" In order to shed some light on the issue of the number of native lupus patients, you collected some reconnaissance from several clergymen in the countryside and asked me how I thought one could draw any conclusion about the whole from these scattered reconnaissances.

Although a procedure such as that used by you can already produce useful results, the material in the present case is too scant and does too little in important respects to give it any value. Nevertheless, I have made the calculation which you asked me to make, but after our conversation we are agreed that not only do you not have any

has scientific value, but that one should not build too much on it, or even less so for practical use.

Of the 65 schemes that were sent, I eliminated 2, some of which concern cities (one with an o, the other with 2 patients), and I then distributed the remaining 63 as follows:

So the distribution is fairly even, and the number of patients should then be 82.5 percent of the number of pastorates. Now there are about 1000 country pastorates, but as part of these are connected with a town or a place of commerce, the most correct count for the country population alone is about 950, and the number of lupus patients should then be 784.

As we have here separated the rural population from that of the city, the former can only be counted as 3/5 of the population of Denmark as a whole, and if you will accept the 784 and assume that a corresponding ratio can be transferred to the city population, we get so, for that matter, 523 patients. On the whole, then, your material used in this way should lead us to put the number of lupus patients in Denmark at around 1300."

Although Director RUBIN's judgment of the result is so hopeless that it might seem best to leave the question alone, I shall add a few remarks and clarifications. Namely, the question is of the nature that it is impossible to obtain exact figures and a reliable result, but therefore one must not completely give up trying to get as close to the truth as possible.

The question here is whether the number 1300 (approx. "2 per thousand) is too large or too small. The two important questions: 1. whether the number of lupus patients was disproportionately large or disproportionately small in the pastorates examined, 2. Whether the incidence of lupus differs between urban and rural populations I must leave open, but I will point out that the number of lupus patients given by the 65 pastorates is quite a minimum, since it are known patients by name and diagnosed by physicians.

While, as far as I know, there have been no studies or clarifications on this question from other countries, there are some studies by Prof NEISSER on the frequency of lupus in Silesia.

Prof. NEISSER writes about this: "I can give the following information about the frequency of lupus in Silesia (with almost 4.2 million inhabitants): I wrote to the 1560 doctors in Silesia asking them to report all known lupus cases to me. Responses were received from only 1,060 doctors reporting 709 cases of lupus. It does not need to be explained in detail that this number does not reach the number of lupus cases in Silesia in any direction. Aside from the fact that only two-thirds of the doctors responded at all, many cases of lupus in the area where they practiced would have remained unknown to those who attempted to complete my inquiry.”

If one assumes that the doctors who did not answer could report a corresponding number of lupus patients, one would get the result that there are at least about 950 lupus patients among Silesia's 4 million inhabitants, i.e. hardly / per thousand , while my number for Denmark was at least '2 per mille.

Notwithstanding this great difference, one must not conclude that lupus is more common in Denmark than in Silesia, for, as I have pointed out above, inquiries to physicians will always result in far too small a number.

But if we disregard these problematic figures and stick to what is available of a more reliable nature, we will see that the number of lupus patients from Denmark alone, which we have already accounted for at the Light Institute, is greater than 4 per thousand (so far we have treated a total of 477 lupus patients from Denmark and there are another 192 who were or are still on the agenda.

If I add that the enrollment of patients (but old cases) is still very large, it is hardly an exaggeration to conclude ') that the remaining number of lupus patients here in the country is not very small, and perhaps will show that the main number which emerged from our investigations is not so far from the correct one.

new

1) Since there are now so many circumstances that can influence the number of registrations, one has to be a little cautious about inferring so much from them. From the establishment of the institute it is a be. steady and fairly steady increase in the number of patient registrations up to the first quarter of 1899, followed by a quiet, slow fall, in the last few months there has been some increase again, without the number of the first quarter of 1899 being reached .

The result of Prof. NEISSER's great work, which has cost both a lot of money and a lot of time, is undoubtedly even smaller and even further from the truth than ours, and does not at all encourage making similar comprehensive investigations here, so much the more less than in a few years, if everything goes as it has been up to now, we will receive excellent statistical material about the frequency of lupus diseases here in the country at the Light Institute.

When we did the research mentioned here, we had no concept of the frequency of lupus disease; when speaking to doctors one could hear guesses varying from 500 to 5000 cases, and if the uncertainty was so great one must assume that something had been gained from our investigations.

vii

Treatment of measles and scarlet fever with exclusion of the so-called che mix light rays.

review article

from

Valdemar Bie.

In an article !) on the treatment of smallpox with the exclusion of chemical light rays, Finsen wrote the following:

“ This treatment, however, is not, as you can see, special for smallpox; it is a new therapeutic principle which, as I have already pointed out above, could possibly acquire a certain importance in other exanthematous diseases and skin diseases; in any case it will be of great interest to clarify the question whether chemical rays have an influence to these diseases or not. It is a special matter with skin diseases, whereas such examinations would be necessary for exanthematous diseases, e.g. B. measles, scarlet fever and erysipelas, very easy to make and also be quite harmless. “Such experiments could easily be carried out in any infectious disease hospital, e.g. B. by letting one sick-room be illuminated for a time with a red light and another with an ordinary light, and then seeing whether there is any difference in the course of the disease; one could also hang red curtains in front of the windows for a few days and then allow the light to enter in the usual way for the next few days”. Now that it is established that the exclusion of the chemical rays of light will certainly prevent suppuration in the smallpox vesicles, it seems to me time to try to treat other exanthematous infectious diseases with red light, and all the more so as one can get out of the Animal pathology a general, from

1) XR FINSEN: On the harmful effects of chemical radiation on the animal organism. Hospitalstidende No. 44, 1893.

disease accompanied by exanthema, which is dependent on the light. When buckwheat is fed to ruminants, the white animals exposed to the light develop symptoms of poisoning from a narcotic substance, as well as vesicular eruption of the skin; the white animals, which stand in the dark, and the black animals, on the other hand, remain healthy.

Of course, one cannot conclude anything about the influence of light on the course of other exanthematous infectious diseases either from the circumstances of this buckwheat disease or from the favorable results of treating smallpox with red light; it seems to me, however, that the experiences mentioned justify the attempt to apply Finsen's method of treatment to these diseases as well. So far, this has only happened to a limited extent, since there are only seven series of tests.

Immediately after SVENDSEN in Bergen had published the first favorable results of smallpox treatment using FINSEN's method, district doctor BIRKEROD !) tried treatment with red light in two cases similar to scarlatina.

T; F. BIRKEROD: Communications from the municipal hospital in Vyborg. l'script for Läger 1894. p. 211.

Both were patients who became free of fever a few days after exposure to the red light, despite the fact that no antipyretic was used concomitantly, and despite the fact that quinine, antifebrine, and antipyrine had had no effect on any of the patients. dr Birkerod, on the other hand, mentions no effect on the scarlatina-like rash present in both cases.

The question of the effect of red light treatment on temperature is very interesting, but it has not been the subject of detailed experimental or clinical investigation until now. Two cases cannot solve this question, as Dr. BIRKEROD quite correctly saw it himself when he remarked that one should not conclude anything from these individual experiments, but that the favorable result nevertheless encouraged the experiments to be continued.

THYMANN,') who tried to treat Scarlatina patients with red light in the Copenhagen Municipal Hospital, had a much better opportunity than BIRKEROD to judge the effect of red light on the course of the disease, inasmuch as he had 36 patients at his disposal. In the meantime he has directed his attention completely one-sidedly to the course of the exanthema. He writes the following about his experiments: “36 patients (with Scarlatina, ref.) were treated with “red light” at FINSENS' instigation. As far as could be judged, the red light had not the slightest effect on the intensity or duration of the rash, with no effect being found on either strong or mild rashes. The initially relatively weak and pale exanthema spread further undisturbed and later became severe

1) F. THYMANN; Diphtheria and Scarlatina etc

Hospital stays in 1895.

p. 270.

intensive; the initially relatively severe exanthema did not fade more quickly with this treatment, but the red light seemed to have a calming effect on several patients.”

Whether the treatment with red light has a beneficial effect on the rash does not seem to me to be the most important thing, since this rash as such does not pose any danger to the patient; at most, such an influence would shorten the exfoliation and, consequently, the isolation. The main thing is whether this treatment affects the course of the infection itself and other reactions of the organism; in particular, temperature, pulse, general condition and cerebral functions (delirium, coma) must be observed. If THYMANX's impression that the red light has a calming effect on patients is confirmed in repeated trials, this is of far greater value than a beneficial effect on the rash, whether it be a milder course of the disease or the low exposure to light the retina is the reason for calming down.

E. SCHOULI !) later tried the action of the red light on two cases of Scarlatina, having obtained excellent results in the treatment of smallpox by this method. There was no desquamation in any of the cases.

FESTNER (Riesa) has informed me in a letter that he has used the red light treatment in a case of scarlet fever. When the patient (a 14-year-old girl) was placed in the red light, she had angina, 40.5° C. and crimson skin; 24 hours later the fever had disappeared, the general condition was good and the patient had an appetite, only the pulse remained at no Th. SCHÜLER in Berlin informed me that he had 26 cases of measles and 14 cases of scarlet fever with red treated light. In all cases he felt that the treatment was highly sedative, even at temperatures of 40°C and above, that the itching was less, and that the exanthema and conjunctivitis disappeared more quickly.

to 106

1) E. SCHOULI (Tunis): Société de thérapeutique de Paris Oct. 11, 1899. Ref.: Journal. f. dietetic and physical therapy, 3rd vol. p. 612.

Provincial doctor BACKMANN 1) in Viborg (Finland) gave a brief statement in his article "Om Variola vera och de kemiska strålarna" that he used the method

, FINSENs also to other acute exanthematous infectious diseases, e.g. B. Scarlatina and Morbilli, has found effective. I have to dr. BACKMANN for more clarifications and he sent me the following reply, for which I express my sincere thanks:

“ Only 5 or 6 cases of Scarlatina occurred in the hospital at that time (that is, during the four years that Dr. BACKMANN was employed as a doctor at the Epidemic Hospital in Kolikkomäki) and were treated by the same method. The rash was milder and desquamation more rapid, the fever resolved in 48 hours, brain symptoms were scarce, and recovery was faster. I could not perceive any influence on the throat symptoms by the method.... After four years the epidemic hospital was closed, but I have always used FINSEN's method in my private practice and have had much benefit from it, especially in the hundreds of morbilli cases I have treated. The fever has always been slight and of short duration, as have the catarrhal affections of the eyes and lungs

low and

1) HERMAN BACKMANN: Finska läkaresellskapets handlingar, vol. 50 no. 5, May 1898, p. 486.

no brain symptoms have occurred. Therefore I have been particularly pleased with the method, and the patients' parents no less; I continually intend to follow this good and practical method of treatment. As the provincial doctor of a large district (6 communes with about 100,000 people), I have not been able to keep journals or take notes on all diseases, but I can say with conviction and experience that Finsen's method is of great and real importance in the treatment of exanthematous diseases is, the course of which becomes milder and faster

One can rightly object to BACKMANN's favorable impression of FINSEN's method of treatment, that it is entirely subjective and, as far as the Scarlatina is concerned, is certainly based on too little material.

CHATINIÈRE !), meanwhile, during a widespread and typical measles epidemic, made some experiments with treatment of measles by red light, by which the observations of BACKMANXS were supplemented in a fortunate way, CHATINIÈRE accidentally making a kind of control experiment case No. 1), ie, he let the patient lie alternately in the red light and in full daylight, just as FINSEN suggested in the passage cited above. The value of the CHATINIÈRES experiment is further increased by the fact that he did not expect any favorable results from the outset, but tried this method of treatment "par simple curiosité".

CHATINIÉRE seems to have carried out the exclusion of the chemical rays of light thoroughly; but he does not mention a spectroscopic investigation. The first case history is so interesting that it deserves to be given in extenso:

I) CHATINIÈRE: La Presse médicale, September 10, 1898, No. 75, p. 78

I

No. 1. “VV, 8 years old, suddenly gets a headache and fever on the evening of July 19th. I was summoned, I diagnose a significant gastric disorder, and since the child is predisposed to this, I order a envelope. Two hours later, during which time the child has been perspiring profusely, an almost general eruption (head and body) of an undoubted nature has appeared. There is photophobia, runny nose and rough cough; the temperature is 39° C.; all this has developed all of a sudden. I ordain a sedative and a mustard poultice around the lower legs. At 9 o'clock the following morning the eruption is more pronounced, the eyes are red and swollen; there is a loud rattle and the temperature has not fallen (39.3°).

I advise then to drape the windows and doors with a curtain of red calico, without any deeper conviction, just out of curiosity. At noon I go to the patient to see how my order is carried out, and I find to my surprise that the eruption has entirely disappeared; moreover, the child, who is now afebrile, has become cheerful, even too noisy; it complains about not being able to see its toys. I then allow the parents, who cannot bear the patient's lamentations, to remove the red curtains.

About 3 o'clock the mother asks me to come quickly: the eruption has returned in full; the fever and dullness are also back. You ask if there are any complications. I calm the parents down, have the red curtains hung up again and give the order not to take them down again. After two hours the eruption had disappeared and the general condition was better. Shortly thereafter, the cough and photophobia decreased. In short, within 48 hours the illness was over and the child convalescent; nothing was noticeable during desquamation. After 8 days the patient had a bath and went out, and this case of measles, which at first looked so menacing, has on the whole gone as quietly as possible from the moment the light was shut out.”

No. II was a 12 year old brother of the previous one. He got the usual initial symptoms. “Right at the beginning of the disease the above treatment was applied, and in spite of the intensity of the premonitory symptoms and the child's constitutional weakness, the measles cleared up in two days; the eruption lasted barely 12 hours. The child got up, got a bath and went out the sixth day without having had the slightest complication. The catarrh of the conjunctiva, nose and larynx was minimal without the use of drug treatment.”

No. III, a 9-year-old child, was ill only four days; there was neither desquamation nor complication. The child got up, got a bath and went out on the sixth day.

No. IV, sister of the first two patients, was placed in the red light before any skin symptoms appeared. The course of the whole illness lasted scarcely three days. Whether an exanthema developed during the stay in the red light is not mentioned; the medical history is very brief and reported in a postscript.

The case histories no. II, III, and IV, taken by themselves, really prove nothing other than that there are cases of measles that run mildly and rapidly, despite the fact that severe premonitory symptoms have been present. More valuable is No. I, where the exclusion of the chemical light rays caused the strong symptoms (severe exanthema, Tp. 39.3', dullness) to disappear in the course of three hours, where these symptoms had returned three hours after the red curtains were removed , only to disappear again over the course of two hours after the red curtains were hung again. If a sufficient number of such control experiments had given the same result, they would have been a sure proof of the excellent effect of treating measles with red light. Of course, this single attempt cannot be regarded as proof, but this and the three other cases of CHATINIÈRES, in connection with the favorable impression of BACKMANN and SCHÜLER of the measles cases which they treated, indicate in any case so much that the treatment with red light has a favorable influence on the course of this disease that one has reason to continue the experiments.

The attempts to treat other exanthematous infectious diseases - apart from smallpox - with red light, have not yet progressed further than that one has to begin almost on the bare ground; This method of treatment must also be tried in these diseases, the more so as it is completely harmless, not unpleasant for the patient, and easy to carry out even in private practice.

AS

FINSENS MEDICINSKE LYSINSTITUTE

(FINSENS MEDICAL LIGHT INSTITUTE)

IN

COPENHAGEN

III

HERAL'S GIVEN

FROM

PROF. DR. NIELS R. FINSEN

THE GERMAN EDITION PUBLISHED

FROM

DR. VALDEMAR BIE

LEIPZIG
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foreword

I. On the Application of Concentrated Chemicals

Rays of light in medicine. Continued Notices

BY NIELS R. FINSEN. (With 8 pictures and figures) II. On the absorption of ultraviolet rays by blue ones

Liquids. By VALDEMAR BIE

III. Investigations into the effect of light

smallpox vaccine. By NIELS R. FINSEN and GEORG

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IV. About the production of arc light with the help of

cooled electrodes. By SOPHUS BANG .
V. On the Effects of Light on Microbes. II. a

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VII. The treatment of the rose with the exclusion of the

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foreword

Dr. GJ Müller (Berlin) has shown us the kindness of taking over the major work of proofreading the translation, for which we would like to thank him very much

to express.

The translation of the book is by Dr. scared.

On the application of concentrated chemical light rays in

# of medicine.

Continued Notices

from

Niels R Finsen.

si

Since in December 1896 I published my treatise Über

the Use of Concentrated Chemical Rays of Light in Medicine” accompanied by a “Preliminary Notice on the Application of the Method in Lupus Vulgaris”, the situation has changed significantly. While I had then used the method for only a year and on 1 case of lupus vulgaris, it has now been used for 6 years and on over 800 cases of lupus vulgaris, as well as many cases of other ailments. What was an interesting, promising experiment in its day has now turned out to be much more, and the method has not only done what it promised, but in many respects has far exceeded my expectations.

The first and most important investigations, which form the basis of the method and on which it is based, are published in the above-mentioned paper, but not so my later investigations, which pursued the goal of improving and expanding the method.

In the various, quite numerous communications, communications from Finsen's Niedizinisches Lichtinstitut III.

About the treatment method, which has so far been emanated from the Light Institute (see list in "Notifications from FINSENS Medical Light Institute" IS 4), it has essentially been about the results of the therapy, which at the same time were followed by notifications about the significant changes and improvements in the treatment apparatus . Against it is so

little has been said about why the changes have been made; I intend to publish these underlying studies here. At the same time I want to give a contextual description of the method and the point of view it stands at the moment, both technically and therapeutically.

These investigations, most of which date back 4-5 years'), are mainly of a physical nature; they have the quite natural trait of being employed solely with specific and practical ends in mind, as if done by a non-physicist. In spite of the shortcomings resulting from this, I want to publish it, since there is a certain reason for it. The method and my apparatus are in fact already being used in numerous places abroad, and I therefore owe an explanation as to why the apparatus and the method are the way they are, why e.g. B. Lenses of glass are needed for sunlight and of quartz for electric light, why clear distilled water should be needed for the electric light collectors and bluish colored water for the sun collectors. These and other relationships

to

1, In carrying out these examinations, I had a great deal of help and support from my two assistants at the time, the doctors Valdemar Bie and Ixel Reyn, to whom I would like to express my heartfelt thanks.

to the

seem to contradict each other and require further explanation. If I don't share the explanations and the experiments on which they are based, I run the risk of misinterpreting the apparatus and technology

Disadvantage for the method changed.

First I must make the remark that some of my investigations will perhaps be regarded as superfluous because the circumstances are regarded as known. To this I can only reply that, since it turned out that various physical data that I had found on my subject (concerning the absorption of rays, etc.) did not agree with my experiences, and since the light intensity, which I am dealing with experiments far exceeded the intensity of light usually employed in experiments, I thought it best to re-examine almost all the questions pertaining to this subject.

The types of these investigations follow naturally from the principles on which the method is based, and these are known to be i. the use of the bactericidal and 2. the inflammatory properties of light, and 3. its ability to penetrate through human tissue.

In order to be used in practice, the light must be highly concentrated and at the same time the large amount of heat must be removed to prevent combustion which the concentrated light would otherwise cause.

The questions which therefore urgently needed to be answered were the following: 1. Which rays in the spectrum are the most bactericidal? 2. To which rays is the inflammatory effect linked?

3. How

What is the easiest and best way to get rid of the annoying heat rays without losing the useful, bactericidal and inflammatory rays at the same time? 4. What about the penetration of light into tissue? Besides this, other questions also arose, which also concerned light, and which depended in part on the answer to the preceding ones, namely: 1. What can be done to produce an artificial light rich in rays with the desired properties and poor in heat rays is? 2. Which part of the electric arc light is the best, that which emanates from the coals or that which emanates from the arc? 3. How does sunlight differ from electric light, and what is the significance of this difference, partly for the construction of the solar apparatus and partly for the treatment of the sick?

This is followed by a series of investigations into how

produces the best concentrated light, so that as many of the good qualities are retained as possible and the harmful heat rays are avoided as far as possible.

I want to deal with the individual questions individually if possible and either answer them or point out where an answer can be found.

ver

1. Which rays in the spectrum are the strongest

bactericidal? I was able to reply to this in my above-mentioned first paper, p. 6, that as a result of numerous investigations - which I have also found to be confirmed in my own experiments - the most breakable, the blue-violet rays had to be regarded as the most bactericidal, whereas some opinions differed differences as to the most breakable, the ultraviolet yielded. During more comprehensive examinations, which were later carried out in the Light Institute by Dr. BIE') have been made on this all-important point, and as I point out, considerably more clarity has been spread as to how an exceedingly large proportion of the bactericidal action of light is to be attributed to the most refractory rays, and how little to the less refractory rays (the red and yellow). dr BiE's investigations are made by means of collectors fitted with glass lenses, and his results are of the greatest importance for all rays which can pass through glass; but a large part of the ultraviolet rays is known to be absorbed by glass, while rock-crystal absorbs them. It was now of great importance to the method to know the importance of these ultra-violet rays absorbed by glass as bactericidal; It would depend on this whether one should possibly use rock-crystal lenses for light-collecting devices instead of glass lenses as hitherto.

I therefore made an experiment in this direction (on May 22, 1897, 10:20 p.m.), which I refer to from my experiment book.

The light from an 80 amp lamp was collected by means of a small collecting apparatus consisting of

a metal tube 6 cm long; one end of which was closed with a rock-crystal plate 6 cm in diameter, and the other end with a rock-crystal lens 5.2 cm in diameter and 6 cm in focal length, with distilled water between them. With the help of this apparatus, the light was collected on a 6 mm diameter spot of a Prodigiosus plate culture, as we use it in the Light Institute, only in this experiment I let the light fall directly on the culture, i.e. on the culture turned away from the glass Surface. I made 3 attempts, each of 5 minutes duration; in the first experiment a plate of rock crystal was placed between the collecting apparatus and the culture, in the second experiment a glass plate of ordinary window-glass, and in the third experiment a somewhat thicker plate of clear mirror-glass. The next day's examination at 1:20 a.m. showed a weakening of the growth on all 3 spots. In the 2 places where the light had passed through glass plates, the growth was about even, but very little weakened; much stronger where the light had passed through the rock crystal slab (the 3 sites were side by side on the same slab culture). On the next day (24th) at 3:20 a.m. the illuminated area was clearly seen on the rock crystal plate; here the majority of the bacteria had been killed, only a few isolated colonies had grown. On the other hand, growth on the two glass plates was just as good on the illuminated as on the non-illuminated areas; the bacteria were pigmented all over, only slightly darker in color on the illuminated than on the unilluminated part. This result, which I found confirmed by later experiments, shows an extraordinary preponderance of the bactericidal power of the extremely ultraviolet rays. A necessary consequence of this experiment was the introduction of rock-crystal lenses instead of glass in the treatment apparatus, and with this, as is well understandable, an enormous amount was gained.

1) Studies on the bactericidal effect of the different parts of the spectrum. Messages from Finsen's medical light institute

IS 40

How much gained by this change

I can't give you exact numbers, but you'll get an idea if I name a few numbers. dr Bie found in his investigations that concentrated light from a 35 amp lamp, concentrated through a glass collector, killed a prodigiosus culture after 35 minutes of exposure. With a rock crystal collector (with 7 cm lenses) and a lamp of the same size, I have been able to kill a culture of the same bacteria in 2-3 seconds.')

To investigate how it behaved with sunlight, I afterwards made some experiments, arranged on exactly the same principle as the last-mentioned experiment with electric light; For this I needed a collecting apparatus with a rock-crystal lens 10 cm in diameter. The result here was quite different, in that there was very little difference in the effects, regardless of whether the light had passed through rock crystal or through a thick plate of mirror glass. Sunlight that had just passed through rock crystal had the same effect on Prodigiosus in 4 minutes as light that had passed through a sheet of glass had in 5 minutes.

From this one gets quite a good practical impression of how great the difference is between sunlight and strong electric arc light, with regard to the content of extreme ultraviolet rays retained by the glass. Sunlight contains comparatively very little of these rays, owing to the high degree of absorption of them by the atmosphere. From this follows z. B. that the sunlight on high mountains is much richer in these rays than in the lowlands (see ABSALON LARSENS treatise: "About the intensity of sunlight". Communications from FINSENs med. Light Institute IS 99). In the strong, elec

1) This number could not be considered as an absolute target for the difference in the performance of the apparatuses, since there are so many sources of error with regard to the cultures that are not taken into account in these experiments (see S. BANG's paper: " About the effects of light on microbes." Communications from Finsens med. Light Institute II. p. 1); but they do give an approximately correct idea of the great difference between these two types of apparatus.

)

, tric arc-light, on the other hand, by far the greatest part of the bactericidal action is due to these ultraviolet rays.

Theoretically, as a result of these experiments, collectors with rock-crystal lenses should be used for both sunlight and electric light, since such devices will give absolutely better and stronger light. But in practice the ratio is different.

First I want to discuss how it is with sunlight. Since the rays are parallel here, the strength of the light, all else being equal, depends on the size of the area of the lens. This ratio is very favorable as far as glass is concerned; as one can easily obtain glass lenses which are as large as one wishes to use them; but unfavorable as far as rock crystal lenses are concerned, since the limits for the size of the lenses of this type of stone are very narrow. The largest rock-crystal lens I saw and could get was 4.5 inches in diameter; but such are very rare and very dear; whereas rock-crystal lenses of 7 to 8 cm in diameter can be obtained fairly easily

although they are of course also expensive').

From my experiment with bacteria described above, it emerged that the ratio between rock crystal lens and glass lens of the same diameter, the same

IO II

1) While rock crystal lenses from

cm diameter cost 150 - 200 kr., those with a diameter of 7-8 cm cost about 30 kr. per piece.

II

e.g. B.

from

20

cm

focal length and the same thickness, at 5 to 4, when it was a matter of utilizing the bactericidal power of sunlight; in other words, only a very small increase in the diameter is required to make a glass lens equivalent to a rock-crystal lens. For example, a glass lens of 11 cm diameter is equivalent to a rock crystal lens of 10 cm. But if

one further considers how disproportionately the area increases in relation to the diameter, so that a lens

Diameter has an area 4 times as large as a lens of 10 cm, one will understand how unfavorable the use of rock crystal lenses would be for sunlight.

It is different with the electric light. In the first place, as I have shown, the usefulness of the rock-crystal is exceedingly greater here than in the case of glass, and secondly, the size of the area of the lens plays a much smaller part, because the rays are divergent. As is well known, a lens of small area placed close to the light can collect as much or even more light than a lens of much larger area placed at some greater distance from the light. Of course, the size of the lens is not absolutely irrelevant, since placing it too close to the glowing embers has certain practical disadvantages (they crack easily and are quickly dusted by the charcoal particles that constantly fall as the charcoal burns). At a reasonably great distance from the arc (12-15 cm.), however, these disadvantages are not very great, or at any rate small in relation to all the advantages of using rock-crystal. Even the high price of these lenses is of secondary importance when one considers the enormous difference which exists between glass and rock-crystal in relation to this light.')

2. To which rays is the inflammatory

effect bound?

I can confine myself to answering this question very briefly by referring to my paper: "New investigations into the effects of light on the skin" (reports from FINSENS med. Lichtinstitut I, p. 8), where I have made them the subject of exhaustive investigations.The answer is, that it is quite the same rays which act bactericidal, and that there is the same or nearly the same difference in the effects on the skin as on bacteria by electric light emitted through glass, or that which has passed through rock crystal.) Consequently, everything I said in the previous section also applies in this section.In order to produce the most powerful possible effects of light, it is most expedient to use rock crystal lenses with electric light and glass lenses to use sunlight.

1) This transition to using rock crystal lenses with electric light was actually a return, by the way, as I had used a rock crystal collecting apparatus for treating lupus as early as the winter of 1895-1896. The development was as follows: I began (Nov. 1895) with a glass lens, but it soon became clear to me that rock crystal could theoretically be seen

was preferable. So I got that one. same winter rock crystal lenses. But since it turned out that they were extremely expensive and you could only get them in very small diameters, I went back to glass lenses. This return to glass, by the way, was certainly all right at the time; partly because at that time I had only a weak arc lamp with relatively few ultraviolet rays at my disposal, partly I had not yet managed to use the double lens system (with space between parallel rays), which of course completely changed the conditions and, so to speak, the advantage of the lenses with a large diameter.

2) Of course, one cannot say with absolute certainty whether they are all the same rays; but so far as one can judge from the methods of investigation which are presently available, they are the same.

3.

What is the easiest and best way to get rid of the annoying heat rays without simultaneously using the useful, bactericidal and destructive ones?

incendiary rays get lost?

It is a physical impossibility to completely eliminate the heat of light, since all rays of light have the property of generating heat, only in different degrees. Therefore, in the question posed, I only spoke of the "sickening" heat, and what I understand by this expression I can definitely state in numbers. With numerous measurements of the heat of the light cone, which the patients could tolerate without feeling pain , I have found that 45-55°C can be set as the average for what is tolerable.

It was now a matter of constructing apparatus which would produce a cone of light with the highest chemical luminous power

just could without exceeding this temperature at the focal point. The work involved has been partly common, partly different for electric light and sunlight, so that I must deal in part with each separately.

Needless to say, hand in hand with these various investigations and as a result thereof, constructions and new constructions of collecting apparatuses have been constantly being made, so that there are various intermediate stages between the apparatuses which we now need and those which are mentioned in my above book from 1896 are discussed. It is not worth dwelling on most of these transitional forms, I will only discuss the most important ones in what follows.

Common to both types of light were the investigations into the ability of water and various solutions to absorb heat rays and chemical rays. Some of the investigations in this direction I have discussed earlier in my 1896 treatise; but the most important investigations are made later.

The questions which it was necessary to answer, as far as clear, uncolored water was concerned, were as follows: What about the absorption by the water with regard to (a) thermal rays and (b) chemical rays? c) What is the significance of the thickness of the water layer? and d) what is the meaning of the temperature of the water? This was followed by e) investigations into the light absorption ratio of the various solutions, in order to find the solution which was best suited to the collecting apparatus, i.e. the solution which absorbed the greater part of the heat rays and the smallest part of the chemical rays.

What

a) The absorption of heat rays by the

Water. For these and the following experiments on absorption I used the light of a 35 amp arc lamp, which was concentrated with the aid of one of my electric light-collecting apparatus as described on lc p. 19. To determine the temperature I used a mercury thermometer, the bulb of which was blackened with soot

was. In all experiments, the thermometer was held at the same point in the light cone, at its focal point.

First I measured the temperature without having filled the apparatus with water, it showed 325° C. (mean number of three measurements 290°, 360° and 324°), then I filled the apparatus container with water, and the thermometer now showed 111. (Average number of 6 measurements, varying between 890-123°.) The thickness of the layer of water through which the light passed was 13 cm.

The rather large difference in temperatures in the experiments, which were made with fairly large intervals, is due to the lamp, whose light is seldom uniform for any length of time on the same spot; because even if the current and the voltage are kept completely unchanged, e.g. B. the shape of the crater cause a big difference in the light intensity. For my purposes these results were fine enough.

It can be seen that the water layer has reduced the temperature of the light to over 200°.

Since you

Now knowing that water absorbs only a very small amount of the visible rays of light, this loss of heat must therefore be mainly due to an absorption of the invisible, ultra-red rays of light.

In order to find out whether all the ultra-red rays, or how much of them, were absorbed by the water layer, I placed a light filter 1 cm thick, filled with an opaque solution of iodine in carbon disulfide, between the apparatus and the thermometer (this solution absorbs all rays of light , except for the ultra-red rays), this one now showed 26° (room temperature 20"). From this it can be seen that the water layer has almost completely eliminated the ultra-red rays. If

before

and

I put the same filter at the same time to make a control attempt

emptied the water tank of the collecting apparatus, the temperature at the invisible focus rose to 1720.

b) The absorption of chemical rays by

Water. Water is the most penetrable, or one of the most penetrable, liquids for the chemical rays of light, and experiments can show that the chemical action of light is lost when it passes through a layer of water. reality is completely vanishing. In the case of glass apparatus, it can even be shown that the water is beneficial; For if one measures the chemical action of the cone of light after it has passed through an empty glass light filter, and then measures the action after the light filter has been filled with water, it will be seen that the action is strongest in the latter case; this is explained by the fact that the reflection from the glass sides is lower when there is water in the filter than when it is empty. I carried out my experiments on this by letting the cone of light act on silver chloride paper (Aristo paper). The paper was applied to the same spot on the lick cone in all trials and the trial time was the same in all comparative trials. By then comparing the colors on the areas blackened by the light, I was able to get a quick and, for my purpose, sufficiently reliable idea of the absorption of chemical rays.)

1) As far as I remember I didn't write anything about this in my experiment book, all my experiments were carried out with distilled water, which we always use for apparatus and light filters. With regard to the absorption of the extreme ultraviolet rays, there is a difference between ordinary and distilled water (see ABSALON LARSENS treatise, Announcements II, p. 110).

c) The importance of the thickness of the absorbent

water layer. From a practical point of view it is of great importance whether the collection apparatus can be constructed with a thick layer of water or whether one can be satisfied with a thin layer. In the case of apparatus for electric light it has comparatively less to say, since these are fixed and supported by strong iron arms. For the solar apparatus, on the other hand, this question is of very great importance. If the water layer is large, the apparatuses become very heavy and cumbersome; as an example I will cite the solar apparatus described in my above-mentioned book, p. 17; it has a water layer 40 cm thick and contains 10 liters of water. Because of its weight, it was difficult to transport, its use was cumbersome and it is therefore no longer used.

I made the experiments with the same lamp, the same apparatus, and in the same way as described on p. 12, gradually filling light filters of various thicknesses with water and placing them between the apparatus and the filter. Since I didn't have filters of all thicknesses, I sometimes put several filters in a row, which does not correspond absolutely to the same thickness of a single filter'), but as can be seen from the figures - this does not play a significant role in experiments as crude as mine.

11 The more glass surfaces the light passes through, the greater the loss of light through reflection.

The results of these tests are given in the table below, in which I give the thickness of the water layer, the number of filters and the temperature.

It can be seen from this table how important even a thin layer of water is, and what comparatively little advantage is gained by making the layer of water very thick. Consequently, one should not employ a thick layer of water, as this has the inconvenience of making the apparatus heavy and cumbersome, while it would be convenient to employ a thick layer of water where these considerations need not be taken. With solar apparatuses, which have a large diameter and often from one place to

have to be brought to others, as mentioned above, this plays a major role; therefore, in the latest constructions of these apparatuses, I use a layer of water only 4-5 cm thick. In the case of apparatuses for electric light, the relationship is reversed, the lenses have a small diameter and the apparatuses are firmly attached, so a thick layer of water can be used here without any inconvenience; I therefore need a water layer of 35 cm for the newest forms.

d) The importance of the temperature of the absorbing

water layer. It should be assumed that the temperature of the water layer should be of importance when it comes to the absorption of heat rays, in such a way that cold water absorbs more than warm water. This seems to be the general view, since almost all medical investigators who have worked with light without heat have stressed passing the light through a layer of water which has been kept constantly cold. A decision on this question was all the more necessary for me, since the water in the light -gathering apparatus became very warm after a few hours, almost reaching the boiling point, and cooling the water down by constantly flowing cold water through it in one way or another was very cumbersome thing, which I only wanted to resort to if

it would be very necessary.

My experiments on this were carried out with the same lamp, the same apparatus, and in the same manner as in the above investigation. There was no water in the apparatus itself, but a light filter 1 cm thick was placed between the apparatus and the thermometer. This light filter was gradually filled with water of 5°, 45° and 73°. The corresponding temperatures, measured at the focal point, can be seen in the table below. I can't remember how many attempts of this kind I made, only the following are noted in my book:

Messages from Finsen's Medical Light Institute III.

2

Filters from I cm

water 50

Tp. 74°

450

1989

73°

180° From these measurements, the variations of which may be reckoned within the normal limits of error (see p. 13), I had seen in each case that there was no significant difference in the absorptivity of the water, whether cold or warm, and I therefore did not consider it necessary to make arrangements to cool the water in the collection apparatus. If, despite this, I later (see p. 38) switched to cooling the water in the apparatus, the motives were different.

Before concluding my remarks on water, I wish to point out that it is absolutely necessary to use freshly distilled water for both solar and electrical appliances; for there are, apart from the possible absorption ratios (see ABSALON LARSENS article cited above, p. 110)—two practical considerations which make the use of ordinary water disadvantageous. Firstly, as the water warms up, numerous air bubbles are deposited on the lenses, causing them to lose an extraordinary amount of light intensity. Secondly, ordinary water gradually deposits calcium salts. We have also tried using boiled water, but so far have not been able to get it clear enough.

e) Studies on the absorption of heat and chemical rays by various

Solutions. As discussed in my essay pp. 14-15 above, I used to my collecting apparatus, both

to

to

for electric, as for sunlight, a solution of methylene blue to remove more heat rays of light than water alone is capable of. In order to find out which solution is best able to absorb heat rays and at the same time allow chemical rays to pass through, I made a series of investigations.

First, I spectroscopically examined all the clearly soluble blue colors I was able to create; I found that methylene blue, alkali blue, and an ammoniacal solution of sulphate of copper best suited our requirements. Spectroscopic examination of the first two showed an almost completely uniform absorption spectrum, but the methylene blue spectrum seemed to be the most favorable, and I therefore carried out a series of comparative experiments with this substance and the ammoniacal solution of sulphate of copper, in order to directly, with the help of of the thermometer and photographic paper to determine their ability to stop the heat rays and to let the chemical rays pass.

Since these are the same dyes which I discussed in my above-cited paper, and since later, more detailed investigations have shown that the assumption I made at the time was not entirely correct, I will quote what I said at the time , and correct the conditions at the same time. It says in 1. c. P. 15: “since the ammoniacal solution of sulphate of copper quickly rubs off on contact with the metal sides of the apparatus and the use of the same is less pleasant, I have now switched to methylene blue solution. The sulphate of copper, if it is strong enough, completely shuts out the red rays, but a strong solution of methylene blue does not. On the other hand, on spectroscopic examination of a faint resolution—apparently of equal intensity—of the two colors, it will be seen that the methylene blue solution absorbs more red rays than the copper vitriol solution; and since, as a rule, one only has use for a partial exclusion of the red rays, the methylene blue solution is to be preferred for this reason as well.”

The experiments which I am about to describe were made with the same lamp and collecting apparatus as in the above experiments on the absorption of water, and with the same light filter 1 cm. thick. The temperatures given here could therefore be easily compared with the temperature (180°) discussed above for a layer of water 1 cm thick; With such a comparison, one gets an impression of the filtration of light through blue-colored water.

For the experiments I prepared 2 deep blue solutions of methylene blue and sulphate of copper with ammonia, which appeared to be of even color strength. The light filters with these resolutions were then alternately placed in front of the light cone and the temperatures in the focus were measured.

The result of the experiments was that I found an average number of 61° for the copper solution and 116° for methylene blue (for clear water, as I said, the temperature was 1809 under the same conditions). Now, examining the effects on photographic silver chloride paper, it was found that the copper solution allowed more chemical rays to pass than the methylene blue solution.

Water was then put into the collectors (a water layer of 13 cm). As mentioned above, the temperature was 111°; if the copper filter was put in place, the temperature in the focus fell to 34", if the methylene blue filter was put in place, to 57o.

As mentioned, the solutions used here were quite dark; in experiments with a weaker solution (the same solution half diluted with water) and with water in the collection apparatus, the temp. in focus was 45° for copper solution and 58° for methylene blue solution.') From this last experiment, however, the correctness of what I said at the time emerges about the difference between a weak and a strong methylene blue solution compared with the copper solution. The main result remains, however, that the ammoniacal solution of sulphate of copper is absolutely to be preferred, both with regard to the removal of heat and the lesser absorption of chemical rays.

Comparative experiments, arranged in the same way as the latter, have also been made between an ammoniacal solution of copper sulphate and various solutions which are said to have a particularly high power of absorbing heat rays, namely: solutions of alum, of sulphate of iron, of chloride of iron, and others; but the result was that the copper solution was far preferable to the others. - For these reasons we now always apply copper solutions to collectors when more heat is absorbed

2) Since it is surprising that this number is about the same as that of the stronger methylene blue solution, I will give the results of the individual measurements. Both numbers were the mean number for 3 measurements; with a strong solution the temperatures were 57°, 54° and 61°, with a weak solution 699, 480 and 560.

than water alone can. We try to reduce the aforementioned disadvantages of using copper solutions (rapid decomposition, etc.) by coating the metal that comes into contact with the solution with asphalt paint.

We need a constant solution of copper for solar collectors, as it affords greater benefits. We also used them for collecting apparatus for electric light for a time, as long as we still used glass lenses; but when the rock-crystal lenses were introduced, the copper solution could no longer be used, as it absorbs the chemical rays to a still higher degree than glass in the liquid thicknesses here in question.

4. Penetration of light into tissue (printed glass).

In order to allow the chemical rays to penetrate the tissues as deeply as possible, we always use a pressure glass, which pushes the blood away from the area to be treated, which, as I have demonstrated, 1. c. pp. 31-33, is of great importance. This is of course of the greatest importance where the treatment of deeply infiltrated areas is concerned. On the other hand, we have learned that with very superficial affections

man

can also reach the goal without pressure glass, e.g. B. in some cases superficial lupus of the eyes

from

WHERE

it

angle and the upper eyelid where it was not possible to use the pressure glass because of the eye. It is clear that the pressure glasses, the bodies

Places must be shaped differently according to where they are to be attached. Besides the forms previously discussed, I. c. p. 33, I want to mention a pressure glass with a concave plate (for treating the vertex) and a special shape, a small oval pressure glass with a handle (see Figure 1), which we use for treating the corners of the eyes and other places, is difficult to apply the ordinary pressure glass.

Of greater importance is a change which I introduced (1897) in the pressure-glasses, and which I shall discuss at length, as in fact representing a great practical improvement in the method.

This modification consists of the use of a hollow, water-filled pressure glass through which cold water flows continuously by means of a supply and drain pipe.

In the constant striving to eliminate the uncomfortable warmth of light, I had hitherto, as can be seen from the foregoing, tried essentially to approach the goal with the help of mediums which absorb the rays of heat. It was my experience that the sensation of warmth diminished as soon as the pressure glass was pressed against the skin; but one day when I was trying to put the light of a collecting apparatus on my arm and felt a great burning sensation, although the light had passed through a thick layer of water, we tried sprinkling water over the skin, and the sensation of warmth completely disappeared. Same thing happened when

you put a pressure glass on the skin and the same of water

ü left berries. Further experiments showed that even extremely warm light, which immediately caused the most terrible pains in the arm, could be tolerated as soon as one rubbed the skin with one of

water trickled down

Pressure glass covered.

However, since a constant trickle down is not easy in practice in the treatment of the sick

is feasible

I tried whether Fig. 2. 2/3 natural size.

one could not be satisfied with a hollow pressure glass filled with cold water. ') The experiment showed, however, that the advantages brought about by constantly changing the water were so disproportionately great that

I decided to introduce the flow-through hollow pressure glasses discussed. As a result of this change, the pressure glasses, or as they should rather be called, pressure apparatuses, have been given two tasks, one being to push away the blood and the other to have a cooling effect on the skin (through conduction).

to act (by direction). These two functions are so important and essential and of great importance that the third effect which they perform, viz. absorbing heat rays, is quite out of the question from a practical point of view

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1) While, as I have shown before, it is quite unimportant whether there is warm or cold water in the tanks of the collecting apparatus, since the water's ability to absorb heat rays is approximately the same in both cases, it is quite different with the water in pressure glasses, which should have a cooling effect through conduction; in this case, of course, the colder it is, the more the skin cools down.

can be left. - As soon as there were no water in the collecting apparatuses, they would be of great importance, since even a thin layer of water (see my table p. 16) is of extraordinary use. But since the application of a layer of water in the collecting apparatus is not a disadvantage but, on the contrary, a great advantage, since the water layer can be made very thick in one case (electric light) and blue in the other case (sunlight), this arrangement is self-evident preferable. It can also be seen from the table above that the thermal radiation absorption of the pressure apparatus is practically irrelevant, since almost all the thermal radiation that can be absorbed by water is already absorbed in the collecting apparatus.

How great a practical importance the introduction of these pressure apparatuses with water trickling has is perhaps best illustrated by the following experiment. I attached a hollow pressure apparatus to my arm, through which water (12° C.) flowed, and then exposed my arm to the cone of light from a large sun-gathering apparatus. (A glass lens from

about 30 cm diameter with clear water.) I now checked how close my arm was to the focal point

could bring to focus without feeling pain. The distance from the lens was then measured, and a mercury thermometer, the ball of which was blackened with soot, was placed in exactly the same place. The temperature showed a high of 220-230° C.; a piece of wood placed in the same place, that is, where my arm had been — immediately sent out pillars of smoke and glowed. If one now considers that the temperature of the light cone, which one could generally withstand with the printing apparatuses used up to then, was 45-55o C., one will understand how important this improvement in the printing apparatus was, and how much more so Light we could use in the treatment after introducing the same. While in the past we were not allowed to use lamps stronger than 35-50 amps, we could now use lamps of 60-80 amps.

The reason why the skin can be exposed without pain and damage to radiant heat, which would otherwise char it, is, of course, that the cooling, the conduction of heat, occurs more rapidly than the heating of the skin by absorption of the heat rays. A substance which conducts heat well is therefore to be preferred, and since rock crystal, like all other precious stones, is a significantly better conductor of heat than glass, its use in pressure apparatus is preferable to glass for theoretical reasons. I will add that this advantage in conducting ability is great enough to be of practical importance. - Since we introduced rock-crystal lenses in apparatuses for collecting electric light, as discussed before (p. 6), we naturally did the same in apparatuses for printing; it can be seen, then, that there are two reasons for the use of rock-crystal; and one now understands the apparent lack of consistency in our employing converging lenses of glass for solar treatment, but using pressure apparatus of rock-crystal.

solar collectors. The form of the latter has not changed so little in the course of time, as a result of the investigations into the absorption of light described earlier. From the form for collecting apparatus, which we find described on lc p. 17, to the form which we now employ, and which has undergone no essential changes in the last three years, there have been numerous stages of transition. Although it may seem unnecessary to discuss these intermediate forms, I shall do so with some of them, in order thereby to have an opportunity of telling why we have not been satisfied with these forms; this is the best way to prevent others from starting down the path again in the belief that they are making improvements.

he solar apparatus, which is described in lc p. 17 but which was by no means the first form, consisted of 2 solid glass lenses, one of 30 cm diameter and another of 18 cm diameter; between these two was a layer of water 35 cm thick. The apparatus contained 10 liters of water, was difficult to transport and set up, and so difficult to move from one place to another that we often preferred to change the patient's position according to the movements of the sun.

In the investigations discussed earlier (p. 15) on the importance of the thickness of the water layer, it has now been shown that such a thick water layer was of relatively little advantage. I therefore constructed the following solar apparatuses with a much thinner water layer, which made them significantly more manageable.

Because the massive large glass lenses were relatively expensive, I tried to create some hollow glass lenses; but not having the good fortune of finding a glass-work which could and would make the same, I tried large watch-glasses cemented in a metal ring; these lenses were significantly cheaper, but only became really useful after

ver

were about 100 times cheaper than the others), I went back to using solid glass lenses, but in such a way that I made only one side of the apparatus consist of a lens (flat-convex, with the flat side against the water), while the other consisted of a flat sheet of mirrored glass.

In the meantime it soon became evident that it is impractical to use very large lenses (40 cm in diameter) for reasons to which I shall return later. The size 20-30 m in diameter proved to be the most suitable, and a glass of this size was not difficult to obtain, but only one with a fairly strong curvature. The result was the rather short focal length of the lens (30-40 cm) , which is why the collection apparatus always had to be placed very close to the patient. As this proved very inconvenient, I proceeded to flatten one side of the lens using mirror glass instead of the one curved glass; this made the focal length twice as long and the use of the apparatus much more convenient. This is the simple reason why the lens in the solar apparatus is always fachconvex, a relation which constantly raises many questions.

Meanwhile, until now, I have not been able to get glasses as good as I could wish for. Due to the method of manufacture - as far as I know a large ball is first blown from which the lenses are cut out in segments they are never completely accurate and never collect the light as well as ground solid lenses; the cross-section of the light cone at the focal point is often irregular (angular, oval, etc.). Since I thought that perhaps more was actually lost by this irregularity than what was gained in the other direction, namely by the cheapness of the lenses (see

was.

I got curved glasses specially made for this use. However, it only succeeded after numerous unsuccessful attempts, as some technical difficulties are connected with making them of significant size and precisely spherical.

The advantage of this was that the light was collected nicely, so that the cone of light was regular and round at the focal point

Next, the further advantage was that the blue-colored water layer was the same thickness everywhere. If, on the other hand, the lens is made of curved glass, the layer of water is of course thickest in the middle, which is unfavorable, since then the central rays (which are to be regarded as the most valuable, since they can be collected best and are refracted the least) have to pass through the thickest layer of water and are therefore more strongly absorbed than the peripheral rays. But when I made comparative experiments with two apparatuses of the same diameter, and under exactly the same conditions, it was found that the curved-glass apparatus, notwithstanding its inferior ability to collect light, killed bacteria faster than the solid-lens apparatus. This difference must no doubt be due to the greater absorption of chemical rays by the thicker glass. So here the cheapest was the best at the same time.

In order to possibly eliminate the disadvantage of the greater thickness of the blue water layer in the center than in the periphery, which was of particular importance in the case of the large apparatuses, when the liquid was to be relatively dark in color when the sun was strong, I made a few experiments.

I constructed some apparatus whose lens was filled with clear water; either in front of or behind it I brought a light filter with flat walls, and on.

out

filled with the blue liquid. With other apparatuses I used plates of blue glass instead of filters, so that one could use one plate when the sunlight was weak, and two or more plates when the sunlight was stronger. The apparatuses with the light filters were soon abandoned as they proved too heavy and cumbersome, as were the apparatuses with the blue glass plates because it proved impossible to obtain glass of a matching colour. A comparison with colored solutions (copper solutions) showed that blue glass allowed more heat rays and fewer chemical rays to penetrate than the blue solution. I then attempted to cover the flat surface with clear blue-tinted gelatin, but this also proved impractical. All these and other methods of achieving an even absorption of the heat rays over the area of the whole lens later proved to be quite superfluous, since it gradually became clear to me that there was no advantage in using very large lenses.

Experiments showed that when the liquid was made very deep blue, which was necessary for large lenses because they heated up so much, they absorbed so many chemical rays that the advantage expected from the large area of the lens was in fact lost, so that these large lenses were often of even less use than lenses of considerably smaller area filled with lighter solution. Experience has shown that for this reason it is impractical, in any case below our latitude, to use lenses with a diameter greater than about 30 cm.

One may ask here whether it would not be better to use large lenses in order to enlarge the treatment spot in this way, so that a larger area could be treated at the same time. This, however, could not be done, because the light outside the focal point of the lens collects too unfavorably to be used. If you want to use the light inside the focus (between the lens and the focus), you get a disproportionate amount of light in the periphery of the spots and very little light in the center; if, on the other hand, one wants to use the out-of-focus light cone, one gets the exact opposite, namely too strong and warm light in the center and very weak light in the periphery. This relation can be easily and clearly ascertained by placing photographic silver chloride paper on the various parts of the cone of light and examining the form of the blackened figure.)

I must add that I have made attempts to collect the sunlight with a silver parabolic mirror instead of lenses; but I gave it up quickly, as the collected light was exceedingly warm and at the same time relatively poorer in chemical rays. I mentioned earlier (p. 8) that I also made comparative experiments between solar apparatus with glass lenses and with quartz lenses.

The result of these investigations and the experiments

1) I must remark that the problem might be solved in part by the manufacture of solar apparatus with a very slightly curved lens, such a lens would give good focus to a larger area; but for the first I have not yet succeeded in getting large glasses that are so slightly curved, and for the second the very long focal length that such a lens would have to have would entail frequent changes in the location of the collecting apparatus, so that the advantage of such apparatuses possibly very low or equal to o in practice . Attempts in this regard would be advisable if one can get such lenses made.

with the here mentioned and other forms of collecting apparatus is that for the time being I have stopped at a collecting apparatus of the form which I am about to describe and which can be seen from the attached picture.

The apparatus consists of a tripod and

and lens. The tripod, which is intended to be placed on a table, carries a fork at the top, which in turn carries the converging lens. This last canoe can be rotated both on a vertical and on a horizontal axis, raised and lowered according to whether the sun is high or low.

We have collecting lenses of different diameters and focal lengths; but the dimensions which I regard as the most favorable are according to the Danish degree of latitude

calculations are a DiaFig. 3. 15 natural, size.

meter of about 25 cm, a focal length of about 70 cm and a distance between the two glasses that form the lens of 4-5 cm in the periphery. It makes no difference whether one wishes to use biconvex or flat-convex lenses, care must only be taken that the lenses are as thin as can be combined with sufficient power.

What

Those converging lenses

one fills

with distilled water, colored blue with an ammoniacal solution of copper sulphate, which is of course always perfectly clear and transparent. The strength of the solution cannot be specified as it must vary according to the strength of the sunlight.

As a medium-strength color solution, you can use 0.3 grams of Cupr. sulfur dissolved in 900 grams of distilled water to which grams of ammonia water (4%) have been added. If one wishes to strengthen or dilute the solution, this is done by adding more or less copper sulphate; the amount of ammonia, on the other hand, must always be the same. A stronger solution than 3 times as strong as the one mentioned above should not be used, otherwise too many chemical rays will be absorbed.

If, despite all this, the light heats up too much, which hardly happens with a lens with a diameter of 25 cm, it is better to cover a smaller or larger part of the segment of the lens instead of making the liquid bluer.

I need not state any limit for the decreasing strength of the solution, as it is, of course, best with regard to the chemical rays to have a liquid which is as little colored as possible. If the sunlight on this or that occasion warms so little that the liquid can be made quite clear means

it is only that it is better to use a lens of larger diameter and with blue-colored liquid.

In addition to these apparatuses, small tables are also used for sun treatment, which are well fixed and provided with a tabletop protruding to the north (since the table legs make it difficult for the patient to approach).

must be, as well as with a water line for the pressure glasses. As it may be of interest to those who want to use this treatment, I will describe the sun treatment facility of the institute here.

In the courtyard where the sun treatment takes place, two rows of small tables (28 in all) are set up. The tabletops, which are either round, with a diameter of half a meter, or square, are supported by a pole driven into the ground. The distance between the tables is 23 meters. Along the rows of tables is up in the air on 2! Feet high on pillars, a water pipe is attached, which discharges just above each table into a tapped drain pipe, from which a gutta-percha hose goes to the pressure apparatus. From this, another hose goes to a drain pipe attached under the table, which opens into a drain channel located below on the floor. This water pipe, as well as the one for treatment with electric light, caused me some difficulties at first because the water pressure was too strong; but now that I've arranged it so that the water line is not in direct connection with the city's water line, but comes from a tank mounted at a height of about 3 meters (up on the floor of the treatment room). It is very good and light. The tank has an inflow pipe, which is equipped with a tap with a float, so that the tank is always filled with water to a certain level. Drainage pipes are located in the bottom of the tank, which supply both the solar treatment water line and the electric light treatment.

For safety, the tank is near its top edge with a drain pipe provided in case the faucet or floats do not function.

Collecting apparatus for electric light. These devices, like the sun-gathering devices, have undergone some changes over time, but not as many as those. The most essential and significant change is that, after an experiment (mentioned p. 5) in May 1897, I introduced exclusively rock-crystal instead of glass lenses. But as I had for some time used glass collection apparatuses of somewhat different construction than those described in lc p. 19 before this attempt for the treatment of lupus patients, and as I have not yet described them in any Danish treatise, I think it proper to give a brief description to give to the same.

As can be seen from the accompanying drawing (Fig. 5), which shows such an apparatus in section, the difference between this and the above is that at the point facing the light there are 2 flat-convex lenses instead of 3, and that the water layer is delimited by two likewise flat-convex lenses. The lenses are of significantly larger diameter (25 cm instead of 17) and the water tank contains about 10 liters of water. While the water tank in the first apparatus was filled with blue solution, in the last it was filled with clear water, while the blue solution was placed in a light filter c: a flat glass container placed in front of the lowest lens.

There were several of the same light filters with different strengths of solution, that

by replacing them quickly and easily, could make the light more or less warm, according to the patient's desire.

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However, we had not had these comparatively good apparatuses long before the introduction of apparatuses with rock crystal became necessary. As can be seen from the above investigations, only rock crystal and only clear water could be used for these devices. The change which the

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The shape now described was necessary, especially in that the light filter was omitted and the metal tube was of significantly smaller thickness, instead of 25 cm in diameter it was now only 7-8 cm, because rock crystal lenses of larger diameter are difficult to obtain. Because of this change, the collecting apparatus now in use (Fig. 6) resembles telescopes, a comparison which is so natural also because the two metal tubes can be pulled apart and pushed into one another, just as in a telescope. While the positioning of the lenses in relation to each other is quite similar to the glass-lens apparatus described, the long, thin form of the apparatus has caused some differences.

On the one hand I could easily make the water layer very thick (about 35 cm), on the other hand I had to take special measures to center the apparatus in relation to the point of light.

Since it is unavoidable that the point of light, even if the lamp is burning with a so-called fixed focus, changes its position slightly, either because the coals are burning irregularly, or because the lamp moves slightly as a result, that the light is slightly crooked in the

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tube falls, and as the path through it is so long and the tube so thin, there is great loss in the lowest part of the tube where the light comes out. In order to remedy this, it is first necessary to fix the lamp as best as possible in the center of the ring, which carries the 4 collecting apparatuses (see illustration on p. 39), with the help of braces and a so-called "wire fence stretcher"; but soon the apparatuses will also be like this to hang them so that they can be centered.This is done with the help of three screws which are located at the lowest hanging point of the apparatuses, while the center which they are

they rotate, is at the top suspension point.

In the newest rock-crystal apparatuses, the top half of the tube, which contains water, is provided with a double wall through which cold water can be conducted, and around

This allows the water in the tank to cool down without replacing it. The water inside the tank is said to be distilled while the cooling water is ordinary. The reason for putting a so-called "cooling cap" on the apparatus, as emerges from my above-mentioned experiment (p. 17), is not that the water absorbs the heat rays better when it is cold, but rather that the water in the apparatus often becomes very warm, and as soon as a lens cracks, the warm water would pour over the patient and possibly scald him; moreover, it is very likely that the apparatus would leak if the water got too hot Since, for other reasons (as mentioned on p. 24), a water pipe had to be established for treatment, it did not take much effort to cool the collection apparatus at the same time.

The last alteration which I made to the apparatus is that the tube which forms the water-reservoir was so arranged that it could be separated in two parts in the middle; the two parts are screwed together and held watertight by a gutta-percharing ring placed between them. Even better, however, is what we have recently introduced, namely being able to disassemble the tube in 2 places, immediately at the two lenses which it closes.' This change was made in order to clean the inner surfaces of the rock-crystal lenses , which close the water layer from above and below. The fact that very careful cleaning and frequent renewal of the water in the tank is necessary was shown in a very interesting way

1) This change is at the same time independent of me from Professor v. Petersen from St. Petersburg.

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Way; in the beginning we only cleaned the lenses once a week, but it soon became apparent that the reaction the day after this purification was strongest; closer examination now showed the need for frequent and careful cleaning in order to obtain the full benefit of the light.

Only very recently I have provided the apparatus with a metal cover, which covers the lowest part of the

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Fig. 8. 9/20 natural. Size.

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tube,

where the light comes from. The lid resembles that used to close a photographic camera; the only difference is that this lid has a lot of small holes. The purpose of this cover is to make it more convenient for the nurses to “set in” the patients. You fall through the many small, regularly distributed holes

minimal amounts of light, whereby the same light image (focus) as usual appears, only very faintly, so that one can easily observe the same without black glasses. The adjustment is much easier and more precise in this way, and only when the diseased area is in the correct position to the light and everything is in order is the lid removed and the full, strong light now falls on the patient. Small as this improvement is, it represents a very great advantage to nurses as well as to patients, who were much embarrassed by the former method of focusing on the intense and burning cone of light. These perforated lids also afforded great advantages in centering the apparatus; if you hold a piece of paper directly in front of the lid, you will see all the holes as small, bright spots, and if these spots are not evenly bright over the entire periphery, the apparatus is not well centered.

The arrangement of the apparatus, the position of the patients, etc., can be seen from the attached pictures. The tripod that carries the apparatus is – yes the change has been made a few years ago that it is no longer supported by supports fixed to the floor but by supports extending from the ceiling, giving greater strength and more space for the patients and nurses.

What is the difference between solar and electric light, and when do you have one and when

apply the other?

The difference between sunlight and electric arc light, which is of practical importance to us, may be briefly expressed as follows.

I. Sunlight contains relatively more heat rays - relative to chemical rays - than strong electric arc light. 2. The maximum of the chemical rays of sunlight lies in a different part of the spectrum, closer to the red rays, than in the case of electric arc light.

The theoretical conclusion that can be drawn from Point I is that electric arc light is better than sunlight for treatment. As the conditions and means of conveying away the heat rays are the same, and the same for both kinds of light, one consequently comes to the focus with the same degree of heat

get a stronger chemical effect from the light cone of electric light than from the cone of sunlight.

The degree of heat at the focal point of the light cone is decisive when it comes to how strong light it is possible to use for treatment. For we do not yet know any reason against the use of any strong light for treatment, and before we know such a reason we must of course strive to get higher and higher in the direction of the strength of the chemical rays. But it must be added here at once that it should be the kind of chemical rays which have the property necessary for therapy of being able to penetrate well into depth (on this later see).

While the degree of heat of the light cone, which the patient could tolerate without water trickling through the pressure apparatus, was 50° C., after the introduction of water trickling, as discussed, it is slightly over 200° C. gone up.

With the latter degree of heat as the upper limit, one can further test how strong light is possible to use. As for sunlight, the scale is lacking because it is so different at different times of the day and season. As stated above, I would like to assume that lenses of about 25 cm in diameter are the most suitable.

Regarding the electric light one can get a little closer to the determination. Experience has shown that with the usual arc light (carbon electrodes) and with my collection apparatus discussed above, light stronger than about 70 amps cannot be used. At 80 amps, the light cone is so hot that many patients cannot tolerate the treatment.

A more detailed comparison of these two types of light will be discussed later, along with an assessment of the various other light sources and the various treatment apparatus. I give here only a few details from which one can to some extent see the difference.

From studies we have done with bacteria, I will assume that all things being equal, strong sunlight would take a few minutes to kill the prodigiosus in plate culture, while electric light would take only a few seconds . In view of the visible effect on the skin, I cannot give such specific numbers; in general I can only say that daily experience in treating patients shows that they get much stronger skin reactions to electric light than to sunlight. It is safe to say that sunlight does not usually cause blistering, while most of the time it does is the case with electric light (treatment time is 4 hours). Incidentally, with regard to this question, I would like to refer to my paper ("New investigations into the effects of light on the skin." Communications from FINSENS med. Light Institute I, p. 8). Herein is mentioned a comparison (p. 14) of 2 experiments on my arm with unconcentrated sunlight and unconcentrated electric light, the result of which was that the inflammation produced on my skin after 3 hours' exposure to sunlight (the experiment was carried out from 12-3 o'clock in the first half of August) was not so severe as that which arose after 20 minutes' continuous exposure to electric light (80 amp. lamp, 50-75 cm. distance).

From what I have presented here, one will be able to form a very clear picture of the superiority of electric light, and yet it is strangely the case that we at the Light Institute have not gotten any particular impression as far as lupus treatment is concerned, that the results of the treatment are worse at the time when there is more sun treatment than in winter when we don't need sunlight; on the contrary, in every case we have formerly been inclined to attribute to the treatment of the sun a more favorable effect on the patient and a more favorable course of treatment.' In so far as this conjecture is correct, we are faced with an apparent difficulty in explanation; but only apparently, because the probability speaks for the fact that another factor is added here, wel

1) This view, which is a pure estimate, probably needs to be changed a bit.

ches to be considered; namely the general condition of the patient. And the fact that the general condition of our lupus patients is better in summer than in winter is a safe experience. This will be partly due to the same reasons which are the reason why summer is generally regarded as the most propitious time for patients with tuberculous diseases; but perhaps it is also due to the fact that the local sun treatment is combined with being in the open air and sunshine and is therefore a kind of general treatment in the sun. Incidentally, it must be remembered that it is a common experience - we hear it constantly from our lupus patients - that the local affections often improve spontaneously in summer and worsen in winter. It is therefore not surprising, for these various reasons, that the treatment of the sun seems to give as good or even better results in lupus vulgaris than the more powerful electric light. The situation is quite different with the other skin conditions, which we have treated with good success using concentrated light. In the treatment of lupus erythematosus, alopecia areata, and telangiectasia, the superiority of electric light is so evident that perhaps it would be best not to treat these ailments with sunlight at all.") This difference in effect on them different ailments

quite characteristic, and may perhaps with some justification be regarded as an indication of the importance of general condition in the amelioration or cure of lupus vulgaris.)

1) It would be possible that one could achieve better results through very long sessions.

2) After writing this I thought about not

The practical consequence of this difference in the action of the two kinds of light, a difference which, it will be remembered, was not present in the early years of this method, but is a consequence of the introduction of rock crystal instead of glass, is, of course, that we now have much need sunlight less than before. Sunlight use is limited to the brightest part of the year (May-September) and the brightest part of the day; in general we only apply sunlight if the weather permits outdoor treatment. The fact that we do not use sunlight in winter, or at all when the sun is low, is due to the fact that sunlight when the sun is low is not only absolutely but also relatively poorer in chemical rays than when the sun is high . This is due to the atmosphere, which has the property of absorbing significantly more chemical rays than heat rays.

One gets a good impression of the degree to which this is the case by looking at the tables for the intensity of the sun's rays in Copenhagen, calculated by our physical collaborator, Mr. ABSALON LARSEN. A few numbers will show it best. If we set the value of the warming effect of the direct rays of the sun at 12 noon on June 21 to be 74, it is

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this relationship could perhaps be explained in another way and is based on the difference between the two types of light (see: The different position in the spectrum of the maximum of chemical rays). There is a lot to be said for, unfortunately we have not yet investigated in more detail, that the less refractive the rays are, the easier they penetrate into the depths of the tissue. The explanation could therefore be a stronger depth effect of sunlight than of electric light.

1) ABSALON LARSEN: The intensity of the sun's rays, reports from FINSENS med. Light Institute I., p. 110.

at 7 p.m. 34; if we set the value of the chemical intensity of the same day at 12 noon to be 119, at 7 pm it is only 5. On December 21st 12 pm we have about the same sun elevation as on June 21st at 7 pm, and the numbers are therefore about the same , namely the thermal effect 33 and the chemical intensity 4.

At first, and before I knew these figures, I thought I could make up for the small power of winter sunlight by the use of larger lenses, but by examining the chemical action of the cone of light when it was as strong (ie, warm) as that Treatment permitted, the chemical intensity was found to be exceedingly slight; but it was only after the exact tables were available that I was able to see the proportions clearly.

Even if one did not have the exact physical investigations into these relationships, one could convince oneself of them by direct observation. As is well known, the sun is red when it is near the horizon and becomes whiter and whiter as it rises higher. This shows that the red rays, the heat rays, are in such extreme predominance when the sun is low in the sky. Conversely, the color of the sun actually becomes more and more blue the less atmosphere the light has to pass through, so that if it could be viewed from a point outside the atmosphere, its color would appear blue (LANGLEY).

With regard to our application of light, the technical difference between these two kinds of light is such that, as previously discussed at length on pp. 8-9, it is most advantageous to use rock-crystal lenses for collectors of electric light, and glass lenses for those of sunlight .

What are the possibilities for improving the

method available.

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Already in my first communication about this method I emphasized that there was certainly the possibility of an extraordinarily great improvement of the method, both with regard to the apparatus and the light itself. Although in the last six years, as I have explained above, there have been very great improvements in the light source as well as in the apparatus, especially the latter, there is no doubt that the method can still be improved and will be greatly improved. I shall briefly indicate the direction in which development will presumably proceed.

The improvement of the light will consist in creating a light which is as rich as possible in chemical rays and as rich in heat rays as possible.

With regard to sunlight, an improvement can only be that

times and places where the sunlight fulfills the given conditions in a special degree. I touched on this question earlier (p. 47), and showed that the sunlight below our latitude is suitable for light treatment only at certain times of the year and of the day. These conditions must of course be known if one wants to use the sun treatment. The location of the place is also of great importance.

We know that the atmosphere mainly absorbs chemical rays; therefore the sunlight will be much better suited to the places for treatment, communications from Finsen's Medical Light Institute III.

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where the air is light and pure, while the places where the air is filled with dust particles and water vapor are less favorable. For these reasons, the sunlight

. generally stronger in the country than in the large towns, with their smoke-filled atmosphere, and still stronger in the interior of the country, where the air is comparatively dry, as opposed to the coast, where it contains much more water vapour.

The height of the place above sea level has the greatest importance; the higher the location, the thinner the layer of air through which the light must pass, and the greater the chemical intensity of the light. In addition, there is the advantage that the air temperature in high-lying places is not as high as that of low-lying places at the same degree of latitude. Heat is of great practical importance. Even here in Denmark it is difficult enough for both nurses and patients to endure the heat in the middle of the day during sun treatment on warm summer days. Of course, the further south you go, the worse it gets. In Greece e.g. B. it has been shown that for this reason the sun treatment must be postponed to the morning hours, when the sun is low in the sky; but this is disadvantageous, since the chemical intensity of sunlight, as mentioned above, decreases comparatively sharply when the sun is low.

The disturbance which the heat thus causes is in fact so great that in practice there are more favorable conditions for solar treatment in the northern countries than in the southern ones. If such dispositions could be made that nurses and patients would be protected from the sun and not suffer from the heat while mian got direct sunlight for the apparatus, it would be a different matter.

It will be seen from this that if it were a question of establishing a major light-treatment establishment or sanatorium for lupus patients, especially in the southern countries, it would be very expedient to establish it on high places. Apart from the great economic importance which the use of sunlight has over electric light, there is the advantage that in such a place, due to the great chemical intensity of the light, one could certainly achieve quite different favorable results than we have in ours Landing with the sunlight is possible. The idea of establishing such an institution or sanatorium for skin tuberculosis on a mountain cannot be so absurd at present, since sanatoriums for pulmonary tuberculosis are being built on mountains. Maybe would be

most natural and easiest to combine such a lupus treatment facility with a phthisic sanatorium, since this may already have an electrical system for the lighting.

Co-operation would be easy here, and could possibly even be done without further electrical equipment, since the light treatment, when there were no sun, could be carried out during the day when electricity is not used for lighting after all. At the same time, it would be a good opportunity for the not a few lupus patients who suffer from pulmonary tuberculosis at the same time to be able to enjoy systematic pulmonary tuberculosis treatment. Incidentally, this combination of lupus treatment and phthisis treatment has already been carried out in practice at the local light institute, by referring to Dr. BANGS initiative a lounger for

set up for lupus patients with chest disease

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to have; at the same time, by distributing milk and haematin albumin to the poorer pa. tients strived to improve their nutritional status. (Because the patients do not live in the institute, we could only partially take care of their nutrition.)

This suggestion of mountain lupus sanatoriums is certainly somewhat outside my subject but may perhaps be of practical interest now that so much can be done and hopefully something will be done for the unfortunate people who suffer from lupus in the way it is done for chest diseases does. And that the disease is widespread enough in most countries to justify such sweeping measures, there can be no doubt, after we have learned how widespread it is in Denmark, a country which is not particularly tuberculous.

But to come back to my topic: the possibility of improving the light source, we are quite different if

is artificial light. Since this

is of great importance, we have worked steadily on this task over the past few years. The investigations went first: 1. by comparing different types of arc lamps to determine which

best suited for us. Accordingly, we had to find out whether 2. the light from the bow or from the coals was the best, and finally 3. at what voltage the light was most advantageous for our purpose. For the determination we used partly chemical reagents (silver chloride and silver bromide paper) and partly bacteria. These last are definitely the best and most practical means of determining the intensity of the light, since it is precisely the strongest

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most bactericidal type of light is which it applies. Through a long series of such investigations, on which I shall not detail, we have found that the ordinary arc lamp of the form which we now use, and which was constructed in part to our specifications, surpasses all others which we have tried , is preferable.

In order to examine whether the light from the arc or from the glowing, positive charcoal point is the most bactericidal, I formed an image of the arc and charcoal by means of a converging lens of rock crystal, and allowed it to fall on a plate culture of B. prodigiosus. The next day the culture showed, much like a photograph, which parts of the light had most strongly affected the plate culture. The least influence was found at the point of the arc, a little stronger at the point of the negative carbon, but by far the strongest at the positive carbon. (This is not to say that the ratio cannot be different with a different arc light.)

The investigations into the voltage yielded the result that the most favorable voltage for the lamp (about 50 volts) also gave the most bactericidal light.

The changes that we have made to the lamps are actually limited to the outer form; the distance between the side poles has been made very large, so that they should absorb as little light as possible. In order not to overheat the lamp's regulating mechanism, an asbestos screen is placed over the coals. In addition, the lamps are set up so that they are absolutely solid

can be screwed into the center of the ring that carries the apparatus.

The reason for such a hasty discussion of these investigations is that the Light Institute has recently been busy working on new lamps with various types of electrodes. These lamps initially seemed to promise a lot, but have not lived up to expectations. They have meanwhile taught us that more detailed investigations are needed into the ability of each type of radiation to penetrate tissues, and that there is little point in working further on the lamps until this question is fully settled. In any case, there is every likelihood that the future will bring better lamps, since the lamps in use now are designed solely for the purpose of illumination, and not with the aim in mind of causing inflammation and killing bacteria. When it becomes clear to the experts in this field that they must construct something new for medical use, progress is sure to come.

The second way to improve the method is to improve the apparatus. I have said a few things about this in the preceding chapters and will therefore be brief. Although the forms which we now use are the result of the most careful investigations, it would be presumptuous to think that they could not be improved in some respects

the solar apparatuses, as well as the electrical collecting apparatuses and the pressure apparatuses - but what these improvements are supposed to consist of is not so easy to say at the moment. One of the most natural improvements we've been working on for some time would be to treat a larger area at once, that is to say

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set up the apparatus and lamps in such a way that the spots of light become larger without reducing the intensity of the light. With the usual apparatus with lenses of 7 cm in diameter one would have a spot of 7 cm in diameter instead of one of 1.2 cm in diameter as is now the case if a flat rock-crystal plate were placed in the lowest part of the tube instead of a converging lens. Of course, in order to achieve the same effect, the intensity of the light must be increased significantly at the same time. Such an enlargement of the spot of light would indeed be very advantageous in extensive cases, but unnecessary in less extensive cases. In the future, therefore, we will probably get devices with light spots of different sizes, so that – as we have already set up – we have light spots of different intensities.

A very practical improvement recently is Dr. Reyn been made. Since the lens closest to the light often jumps, Dr. REYN came up with the idea of cooling them down with water. This is done by placing a flat rock crystal plate 2 cm in front of the top lens. The resulting space contains distilled water, which is constantly being cooled by a stream of water circulating around it. This ensures that the valuable lenses do not crack, but also that the entire apparatus is brought closer to the light and this can therefore be better used.

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Application of the method in practice.

While I have dealt exclusively with the physical part of the method in the previous

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I will proceed to give a description of the application of the method in practice, as well as an account of the therapeutic results achieved so far with the help of the same. As

my first publication on this method, I. c. 43-44, I was aware from the outset of the great potential for development that lay in it, both with regard to its technology and its therapeutic area, and although several of my assumptions and opinions proved to be incorrect (e.g I believed at the time that I could achieve a great deal by using very large solar lenses, which, as mentioned above, was not the case), but in the main my hopes were not disappointed.

At that time (1896), fearing that the method could only be judged on the basis of the relatively good results achieved at that time, I explained - the following 1. c. p. 43 "A judgment about the method from the current point of view will therefore be completely incorrect. Before you have made experiments with very strong light and the best possible equipment, you will not be able to form a definite opinion about their real value." This raises the question of whether we are ready now, or when we will get there, the demands made as fulfilled to be able to look at. To this I will reply that I have learned the method of introducing rock-crystal apparatus and large arc lamps of 60-70 amps.

. which was not fully implemented until June 1898, do not regard as even remotely fully developed. The preceding period, that is, from November 1895 to June 1898, must, as I shall do in what follows, be called the experimental stage.

before

The separation of the experimental stage from the later stage acquires its essential importance when it comes to the results of the treatment, while it is, so to speak, of no importance in relation to the technique or execution of the treatment, which I shall now consider in more detail.

The execution of the treatment. Very substantial changes in execution have not been made, and the description which I, 1. c. pp. 36-38, therefore continues to apply. -- To Ver

, , changes happened the following.

Each spot is now only treated for 5 hours instead of 2 hours, and yet the effect is now much stronger than it used to be after 2 hours. This time (the 5 hours) is not absolute in any way; it is the one currently used in lupus vulgaris, but it is very probable that experience will gradually show that in diseases which are successfully treated by this method, one can either content oneself with shorter séances, or claim longer ones got to. In the case of lupus vulgaris, it is possible that the duration of the séances will be individualized later on, since there is a significant individual difference in the strength of the skin reaction. Currently we are individualizing in such a way that patients, depending on their tolerance for light, are exposed to either the strongest or weakest lights we use, appropriate for purpose, 70 or 45 amps, as well as sometimes having 2 applications in a row get the same job.

In the beginning I had each nurse serve only one patient; but I hoped that later, when they were more practiced, each would be able to get 2 patients. I tried it too for a while, but gave it up as it seemed to me that what was gained economically was lost through poor maintenance. And now, after the introduction of some of the thin, long rock-crystal apparatus, which often have to be adjusted, some of the pressure glasses with water trickling, I think it very wrong to have one nurse attend to more than one patient. In addition to this, the nurses can seldom leave the pressure glass entirely to the elastic band to which it is attached, but must hold it in the correct position and often exert pressure on it with the fingers, which would be impossible if the nurse in question to serve two patients.

A greater difficulty than one might think is related to the proper positioning of the patient. It may be found that this point is of secondary interest and may be passed over, but in fact it is of great practical importance that the treatment should not become onerous to the patient. It is easy to understand how difficult it is to bring the various diseased parts, especially the face and neck, under the cone of light so that the light falls more or less perpendicularly on it and again in such a way that the head is not turned into an uncomfortable position at the same time becomes. Since a séance lasts five and a half hours and one has to keep one's head in the same position during this time, it is of course important to lie comfortably. This quick and easy placement of the patient in a correct and comfortable position to the light is one of the most important, but at the same time one of the most difficult tasks of our nurses. The most practical has been the attachment of patients to bearings with adjustable

Head end shown (the shape we use in hospitals for connecting). The finer adjustment of the head to bring the diseased area under the focal point of the cone of light is done with the help of differently shaped cushions. In many cases when the patient is most easily treated in a sitting position or prefers to sit, we use rocking chairs with great advantage, since they can be adjusted with the help of wooden blocks that are pushed under the aisles. One could certainly construct special chairs that were even better and could be adjusted in all directions , but these would be significantly more expensive and would hardly be of any use in comparison.

The effect of the treatment. Since light treatment already covers a considerable number of skin diseases and its indications are constantly expanding, the description of the treatment and its effects should have a general character. However, as our experience in lupus vulgaris is much greater than in all other diseases combined, I will prefer to give a detailed description of the treatment and effects in this disease as a paradigm, and later in discussing the other diseases add what is particularly noteworthy.

The treatment is currently carried out in such a way that a small round spot (2-3 cm in diameter)

hours is illuminated. To ensure that the nurse does not make a mistake about the spot and that the beam of light is always aimed at exactly the same spot, the doctor usually draws before the treatment begins

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a ring around the area to be treated with a dermatograph. Since we have powerful rock-crystal apparatus and strong light, the same spot is usually no longer treated for several days at a time, as it used to be, if there is enough diseased tissue to be able to choose another spot. The reaction is often so strong that it cannot be done well. There are large individual differences here, because while some patients who have lupus so small that there is only room for a spot can tolerate the treatment for many days at a time, others have to take one or more days off between each treatment.

The visible effect of the treatment on the skin is a strong reddening of the spot and the spot rises above the surrounding skin; there is often, one might say almost always, a formation of vesicles on the spot. The time for its formation varies, between 16 and 24 hours after illumination. This formation of vesicles, which sometimes assumes smaller, sometimes larger dimensions, is very similar to the vesicles after the vesicatoria. Much more frequent and stronger formation of vesicles occurs after electric light than after sunlight. In some cases, the reaction at the treated site is so severe that slight edema occurs in the surrounding skin, especially if the site is around the eyes. Incidentally, one can usually judge by the extent of the skin reaction whether the apparatus and the light are functioning correctly; if the response is very slight, there is reason to believe that something was wrong with the lamp or apparatus; In this way, as mentioned above, we have learned that the apparatuses need to be cleaned very frequently.

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The reaction acquires a second practical interest through the possibility of using it to check whether the nurse was careful or not; if the stain z. B. is very blurred, or there are possibly 2 red spots on the skin, this proves that the cone of light was not always in the same place during the whole séance.

The further course of this skin reaction is: drying of the vesicles and formation of a scab, which falls off after a few days, whereupon new epidermis can be seen formed over the entire extent of the site. This course is constant. Thus, the light treatment does not produce any necrosis of the skin, and no formation or scar tissues occur as a result of the treatment; the new epidermis will

blistering has taken place simultaneously from the whole bottom of the patch.

In my first treatise, 1st c. p. 39, I once mentioned having observed necrosis after light treatment, which was due to a pure burn; I must add here that I later observed only a very isolated case of it. Bearing in mind that the necrosis of the lupus tissues has been deliberately induced in various earlier treatments, any adverse importance will not be attached to these individual cases, especially as they are usually induced by the patients' lack of awareness. by not reporting that the light was "burning."

I will add, by the way, that I have used this ratio a number of times on purpose. They were some isolated lupus nodules that had been very resistant to light treatment; I therefore suggested to the patient that they try to burn away with the help of the cone of light, that is, to use the heat of the light at the same time as the chemical rays. By applying strong pressure with the pressure apparatus, the process became less painful and the patients endured it quite easily. But the result did not live up to my expectations, on the contrary, instead of disappearing, the affection seemed to spread, and considering the painful nature of the treatment and the loss of substance in the formation of the wound, the result of these experiments was in reality proof of the great advantage of the "cold" light.

A significant consequence of the fact that light treatment does not produce a scar and can therefore be used on healthy skin without any disadvantages is, as I mentioned at the beginning, I. c. p. 40 that one can treat the apparently healthy but possibly infected area surrounding the diseased area. Here the light treatment has an inestimable advantage over many other methods, which can otherwise be rational.

Now that the diseased part and the healthy margin surrounding it have been well treated, a change in the diseased parts appears; any ulcerations heal, the surface becomes firm and smooth, and diaphanoscopic examination shows that the characteristic lupus nodules become fewer and fewer, eventually disappearing altogether. The skin on the treated areas will remain red for some time, but will gradually turn pale and regain its natural colour.

This process of change naturally takes a certain amount of time – it is impossible to say how long, since there is such an extraordinarily large individual difference here

it

is present and therefore a certain amount of time must pass before one can properly see the effect of the treatment and state whether the healing is complete or whether there are still diseased points. For this reason, in order to save time and unnecessary treatment, we have arranged that when the diseased areas have been treated liberally and seem to have improved well, the treatment is discontinued for a month or more. During this time there is usually a clear differentiation between the healed and the not yet healed parts; the patient is now treated again, but this time usually for a much shorter time, after which there is another break, and then possibly a new treatment, to the end nothing

, ill be there anymore. It is not uncommon for the patient to be completely healed after the first treatment, but it usually takes several treatments. In my statistics below, I want to show how things have turned out for us. However, it goes without saying that such a statistic can be valid for an individual clinic or for an individual doctor, since it depends very much on how long and how thorough the first treatment is.

That there are many patients who have had to resume treatment numerous times will also be seen from the statistics, but this is also the most unfavorable thing that can happen. The treatment is as safe for lupus vulgaris as can be expected. That among our more than 800 cases there are nevertheless a few in which the effect of the treatment has been very slight, cannot perhaps be blamed so much on method as on other accidental circumstances.

only

it

Since I was keen to make experiments with this new method as pure as possible from the start, so that there was no doubt about it, I used only light treatment in the treatment of the first 130 patients. Later ') we used in individual cases with advantage - before the light treatment, other, older methods of treatment, galvanocaustic, ointment treatment (especially Pyrogallus ointment), etc. and then continued and concluded with the light treatment. The statistics below show how often we have used this combination of treatments. The cases in which we applied this preliminary treatment were especially cases with thick, spongy granulation formations, with heavily pigmented, thickened lupus portions, and the like. It has been shown that in many cases such a pre-treatment accelerated the healing significantly, paving the way for the healing light treatment. The cases which make it difficult for the light treatment to cope with them are, of course, partly the very thick, deep affections, partly the strongly pigmented forms. I must add that we need these strong pre-treatments only in cases where the cosmetic result could not be affected by them, and where it was of less importance than a quick healing (e.g. on the truncus or den Extremities).

In recent years, after the introduction of rock-crystal apparatus, and after the effects on the skin have become more severe and the formation of vesicles more frequent, in order to protect these treatment-induced excoriations, we have treated the patients with boric acid

it

from

1) Since the spring of 1898, patient treatment has been carried out by Dr. ForchHAMMER as senior physician with Dr. REYN as a secondary physician.

strokes, which incidentally also have the purpose of softening the scab and thereby making the diseased parts more accessible for light treatment. We also often need Diachylon — and other healing ones

Anoint.')

(Sequel follows.)

1) After the above is printed (it has been ready for some time) a lot of new lamps and new apparatuses have appeared. I have not been able to discuss them here, but will go into more detail in the following by comparing them with one another and with my apparatus.

ultraviolet rays by blue liquids.

Of

Valdemar Bie.

As described on pages 14 and 18 in Prof. FIXSEXS's preceding paper, he originally treated the patients with electric light concentrated through glass lenses and cooled by passing through a blue, ammoniacal solution of copper sulphate. Simultaneously with the introduction of rock-crystal lenses, he replaced this blue solution with water because some preliminary experiments showed that the blue liquid absorbed ultraviolet rays, thereby losing the advantage of rock-crystal lenses. In the meantime, these preliminary attempts have remained the same. Because it

Since it is of course of great importance to know for certain whether the chemical effect of light is so greatly reduced by passage through a blue solution that the cooled electric light is useless in practice, I made a few experiments at Prof. FINSEX's request to examine this relationship in more detail.

Light from a 25 amp, 48-50 volt arc lamp was concentrated by a FINSEN concentrator with rock crystal lenses. Its first lens was 7 cm in diameter and 11.2 cm from the carbon tips

removed. A small tripod was fastened to the part of the concentration apparatus facing away from the lamp, on which the rock-crystal shells with bacteria mentioned below were attached, and a brass plate was hung on a hanger to shut off the light.

This concentrated light passed through a light filter made of rock crystal or glass, which was filled either with distilled water or with a solution of copper sulphate ('2 solution, to which for every 10 cm 1 cm3 ammonia water

I was fed up). Both light filters had a lumen of 25 mm. The glass plates were 2.7 mm thick, the rock crystal plates 1.7 mm. The front surface of the filter was 40 mm away from the nearest lens of the concentrator. The light cone had a diameter of 25 mm at this point.

After the light passed through the light filter, it hit previously treated bacteria in the following way: A broth culture of B. prodigiosus (15 hours old in the first experiment, 18 hours old in the second) was filtered through filter paper. – I cm3 of which 9 cm3 diluted with water. Drops of this suspension were transferred to the rock crystal plate, which is set in a brass ring, so that the plate and ring together form a bowl. A drop was placed on each plate, which

dried in a desiccator with calcium chloride. Thereafter, the bacteria were illuminated under the conditions given above. The attachment of the rock crystal plate was 130 mm from the nearest lens; at this point the light cone had a diameter of 12.5 mm. During the illumination, cold water streamed constantly over the exposed side of the rock-crystal slab; the bacteria were attached to the opposite side of the plate. After the illumination, I covered the dried bacteria with a drop of agar. the

man

Dishes were finally placed in a PETRI dish with the bottom (rock crystal slab) up on moist filter paper to form a humid chamber.

By doing so I have obviated the very important source of error which represents the absorption of chemical rays by the culture media

When a saline solution, bacterial suspension, or similar dries up, a narrow, raised rim forms on the periphery of the dried droplet. If this is covered with a drop of agar, as I did in this experiment, and the bacteria allowed to grow out, the growth in this rim becomes denser than within it. Illuminating the bacteria, those in the small area inside the rim are killed first, while those in the rim later. The annihilation of

. Bacterial in this raised rim proceeds irregularly, as might be expected. Therefore, when reading the test results, I only considered that part of the dried drop that lies within the edge.

growth

do.

do. no growth

do.

10

growth no growth

II. Rock crystal light filter with copper sulphate solution.

do.
do.
do.

attempt II

growth

do. no growth

do.

do.

7

10

The result of the experiments is that the bacteria are killed under the given conditions

when the light rock crystal and distilled water

happened: in 4-7 seconds;

when the light passes through glass and distilled water

has: in 1-2 minutes;

the light has passed through rock crystal and copper sulphate solution: in 2-4 minutes;

2

if

when the light has passed through glass and copper sulphate solution: in 2-4 minutes.

The significant difference I have found after the light has passed through rock crystal with distilled water, or through glass with distilled water, is due to the absorption of ultraviolet rays by the glass. The difference between a glass of distilled water and a glass of copper sulphate solution is due to the absorption of blue and violet rays by the same. I found no difference between copper sulphate solution in rock crystal and in glass. In other words, a solution of copper sulphate of specified strength absorbs so many chemical rays that the difference in using rock crystal instead of glass is lost as soon as the light passes through the solution.

Studies on the effect of light

on smallpox vaccine.

Of

Niels R. Finsen and Georg Dreyer.

The great influence which light has on the course of the skin affection in smallpox must arouse astonishment. As for the first, there is reason to marvel at the fact that ordinary daylight can have such a powerful effect that the exclusion of the chemical rays alone is sufficient to prevent the appearance of one of the most dreadful disease states known to man, the suppuration stage. As for the second, there is every reason for our astonishment - for our bacteriological age - that the very exclusion of a bactericidal agent has this effect in an infectious disease. If one were to conclude that since smallpox is an infectious disease, it should seem rational to leave patients lying in strong light, preferably blue, as this is particularly bactericidal, one would, from a purely theoretical point of view have little objection to this view.

Such an objection has in fact been raised against the treatment of small-pox with the exclusion of chemical rays. The English doctor, Dr. MOIR, who polemicized against this treatment in The Lancet') - without having tried it - stands exclusively on the ground of the above conclusion. dr M. ended his article with the words that the following applies to smallpox treatment: "light, light, more light".

Experience gained now has greater value than theory, and this has Dr. Moir not right. - Incidentally, the method was by no means lacking in theoretical justification, it only had the fault of not quite fitting into the all-dominant bacteriological point of view of the time. Its correctness is now shown by quite numerous and constant results, which have been achieved with the "red light" treatment, and one must admit: in relation to smallpox, the inflammatory effect of the light is much more important than the bactericidal effect.

There was also the possibility that the pathogens in smallpox behaved differently to the effects of light than the other microorganisms; at least some investigations?) made at the Vaccination Institute in Hanover seem to indicate this. From these it appeared that as soon as animal smallpox vaccines were enclosed in capillary tubes and exposed thereon to diffused daylight or even sunlight for 2-8 weeks, the potency of the lymph nevertheless remained unchanged.

Since it seemed to us that the solution to this question had some interest, we re-examined it.")

1) John Morr. Treatment of small pox by excluding the chemical rays of daylight. The Lancet, Sept. 29, 1894, p. 739.

2) medicine. extra. Message from the Kaiserl. health departments. Vol. 5, Issue 2, p. 94

3) The investigations were carried out by G. DREYER.

The test arrangement.

An electric arc lamp was used as the light source, and a FINSEN concentrator with lenses made of rock crystal was used to concentrate the light.

The diameter of the positive and negative carbon was 2.4 and 1.5 cm, respectively. The tip of the positive carbon was always 11.5 cm from the nearest lens of the concentrator. New carbon (of the same length) was used at the beginning of each series of experiments. In all experiments, the arc lamp burned with 25 amps and 49-50 volts. In the experiments, the direction of the light was always 45" to the horizontal plane and the illuminated area was perpendicular to the direction of the beam

The animal smallpox vaccine used for lighting (common glycerine emulsion) was with great willingness from the royal. Vaccination facility left to the Light Institute, just as they have kindly taken on the no small task, vaccinations with the illuminated one

to undertake vaccines, the latter being of great importance, as it requires a great deal of routine to obtain an even and sure success. For the concession shown to us, we therefore ask the institution and its board, Mr. Dr. medical BONDESEN, to accept our best thanks.

The vaccine to be illuminated was attached as a drop on a flat rock crystal plate set in a brass ring using a platinum wire eyelet with a diameter of 3.5 mm. (The thickness of the platinum wire was 0.2mm). The greatest thickness of the drop was approx. 0.4 mm in almost all test series, with the exception of test series 1 and 2 (approx. 0.3 mm) and 12 and 13 (approx. 0.5 mm).

The drops are always placed in the middle of the rock crystal plate, , on the side facing away from the light source. During illumination, the rays were so arranged that the center of the rock-crystal plate was central in that part of the cone of light which contained the strongest chemical rays (checked with silver paper). The diameter of the light cone was about 1.2 cm here.

Under the lights, the uncovered bowls were sprinkled with cold water to eliminate the heat effect.

Where experiments have been made with clear, blue, or red glass in order to exclude certain parts of the spectrum, this has been done by placing one of the glass plates mentioned between the light source and the rock-crystal plate. Both plates were sprinkled with cold water.

After illumination, one child was vaccinated from each drop through three cracks on the left arm, and a control vaccination was made on the child's right arm in all cases with non-illuminated vaccine from the same glass tube. The control vaccinations on the right arm (also 3 superficial tears) have in all cases resulted in the development of 3 vaccine pustules (i for each tear) of normal, typical shape and size (c:

strong success), which these control vaccinations particularly contribute to makes comparisons suitable. The examination of the vaccinated children is carried out on the weekday after the vaccination.

The vaccine from 11 different calves was used in the experiments. The age of the vaccine varied between 1-4 weeks.

The same series of experiments was always carried out on the same day with the same vaccine, and the individual experiments immediately followed one another.

The abbreviations used in the attached tables are as follows: 3 Vaccine pustules of normal size 3 : strong success. 3 of less than normal size 3 : medium

strong success. 3

of low magnitude 3 : poor success. 3

insignificant size 3 : abortive

Success.

from

Trial Series 1: Vaccine from calf 26. Age of vaccine: 15 days. Illuminated by rock crystal. Largest thickness of the drop approx. 0.3 mm. Vaccination on 9 children.

Trial Series II: Vaccine from calf 30. Age of vaccine: 15 days. Illuminated by rock crystal. Largest thickness of the drop approx. 0.3 mm. Vaccination on 9 children.

Trial Series III: Vaccine from calf 37. Age of vaccine: 16 days. Illuminated by rock crystal. Largest thickness of the drop approx. 0.4 mm. Vaccination on 9 children.

Trial Series IV: Vaccine from calf 37. Age of vaccine: 23 days. Illuminated by rock crystal and red glass. Largest thickness of the drop approx. 0.4 mm. Vaccination on 6 children.

Trial Series V: Vaccine from calf 37. Age of vaccine: 16 days. Illuminated by rock crystal. Largest thickness of the drop approx. 0.4 mm. Vaccination on 2 children.

Trial Series VI: Vaccine from calf 39.

Vaccine: 10 days. Illuminated by rock crystal. largest

Drop thickness approx. 0.4 mm. Vaccination on 4 children.

Trial Series VII: Vaccine from calf 2. Age of vaccine: 16 days. Illuminated by rock crystal, clear and blue glass. Largest thickness of the drop approx. 0.4 mm. Vaccination on 6 children.

Trial Series VIII: Vaccine from calf 3. Age of vaccine: 9 days. Illumination by rhinestone, clear

and blue glass. Largest thickness of the drop approx. 0.4 mm. Vaccination for 10 children.

Trial Series IX: Vaccine from calf 3.

:

. Age of vaccine: 16 days. Illuminated by rock crystal. Largest thickness of the drop approx. 0.4 mm. vaccination for 8 children,

Trial X: Vaccine from calf 4. Age of vaccine: 18 days. Illuminated by rock crystal, clear and blue glass. Largest thickness of the drop approx. 0.4 mm. Vaccination for 10 children.

from

calf 5

Trial Series XI: Vaccine

Age of vaccine: 21 days.

Illuminated by rock crystal. Largest thickness of the drop approx. 0.4 mm. vaccination for 12 children,

35 sec 74

50

75

65

76 80

77

3

3

4

3

moderate success (2 p.)

(2)

(3 ",)

(3,,)

(3")

(2",)

(3 ,,)

no success

weak success (2 p.)

(3)

(2",) no success

Trial Series XII: Vaccine from calf 10. Age of vaccine 5 days. Illuminated by rock crystal, clear and blue glass. Largest thickness of the drop approx. 0.5 mm. Vaccination for 10 children.

Trial Series XIII: Vaccine from calf 7. Age of vaccine: 26 days. Illuminated by rock crystal, clear, blue and red glass. Largest thickness of the drop approx. 0.5 mm. Vaccination on 8 children.

96

3 97 3

3 99

3

3IOI 3

3 103 1 3

weak. E. (3 p.) abortive. E. (1 p.) strong E. (3 p.) medium. E. (1P:)

(2)

(3,,) strong E (3)

(3,,)

15 m

100

한 20

20 st' 102

7th 8th

30,

From the experimental tables it appears: That Vaccine, illuminated by rock crystal under the above conditions, is not appreciably affected by an illumination time of less than 10 seconds.

When illuminated for 10-100 seconds, there is a significant weakening, sometimes even complete destruction.

When illuminated by ico--200s, very severe debuff or total destruction occurs. An illumination time of 200 seconds under the above conditions must be considered sufficient to lead almost certainly to the total abolition of the vaccine's ability to produce vaccine pustules.

For comparison, I only want to note that a Prodigiosus culture that had dried on an agar layer about 0.3 mm thick and was thereby illuminated under exactly the same conditions was killed after 40 seconds of exposure to light.

The experiments also show that small variations in the thickness of the illuminated layer are of great importance. From the series of experiments I and II one can therefore see the destruction of the vaccine after an illumination of 100 seconds, while in the series of experiments XII and XIII even an illumination of 200 seconds produced absolutely no destruction; We find similar conditions when certain parts of the spectrum are excluded (series of experiments XII and XIII.

Experiments IV, VII, VIII, X, XII and XIII show that the destruction of the vaccine, like that of the bacteria, is mainly due to the action of ultraviolet rays.

However, exposure to clear and blue glass for 5 minutes, which blocks much of the ultraviolet rays, has no proven effect. First

U.N

Illumination through clear and blue glass for 10 minutes gives a weakening, and it requires 15-20 minutes of illumination time to produce a strong weakening or destruction.

The relation is still clearer when the illumination is made to proceed through dark-red glass, which keeps out all chemical rays, not even an illumination of thirty minutes affecting the virulence of the vaccine to any demonstrable degree.

The small variations, which some experiments show, can of course be explained by the small differences in the experimental order, which are almost possible to avoid, e.g. B. slight variation in light intensity, drop thickness, etc.

It has not been possible to ascertain any difference in the action of light on vaccines from different calves.

It has often been pointed out ') that temperatures of 30-40 debilitate smallpox vaccines and reduce the duration of their ability to produce pustules. Since it has now been shown here that strong light also has a very harmful effect, the same precautionary measures must be observed when storing vaccines as with known bacteria and their poisons, and they must therefore be kept in cold and darkness (possibly in red glass.

1) LEMOINE: Compt. ren. de la Soc. de biology. No. 12., p. 321

About the production of arc light with the help of cooled electrodes.

Of

Sophia Bang.

After FINSEN referred to the therapeutic use of "chemical" rays of light, a number of attempts were made, both here and abroad, to produce such rays in larger quantities and more cheaply than hitherto. These attempts have partly proceeded from using ordinary carbon-arc light in ways other than that employed by Finsen, and partly from trying to use or produce new sources of light with a greater richness of chemical rays. It is only these last endeavors that I shall briefly discuss here.

Since many metal spectra contain a great wealth of short-wave radiation, i.e. radiation with a strong chemical effect, it is understandable that special attention was paid to these. Thus , as early as 18961, FINSEN described an experiment which he carried out on the basis of Prof. LA COUR's suggestion, in that he used calcium in such a way that a mixture of lime and graphite was placed in a bore in the positive electrode, which, as usual,

1) "On the use of concentrated chemical rays in medicine, p. 46.

made of coal. The light thus produced turned out to be very rich in chemical rays; but the experimental results were not put to practical use at that time, mainly because the glass-collecting apparatus then in use made the usefulness of the ultraviolet rays produced illusory. A year later I tried to use Magnium, partly as a metal, partly in various compounds; In this way, too, the richness of light in ultraviolet rays can be increased, but it has not been used in practice. MAGNUS MÖLLER') used a zinc wick in his experiments on ultraviolet rays. Later, STREBEL ?) suggested the use of aluminum oxide and aluminum silicate, as well as zirconium, in addition to the substances mentioned. He also used electrodes of metallic cadmium, aluminum and zinc by jumping high-voltage induction sparks between the poles of these metals, thereby obtaining a light exceedingly rich in ultraviolet rays. An experiment with mercury as the positive pole and carbon as the negative pole, using a direct current, was made in the winter of 1900-1901 by KJELDSEN at FINSENS Light Institute, using ARON's and HEWITT's mercury lamps as the starting point. In this way, too, a light exceedingly rich in ultraviolet rays is produced.

Iron is a metal that, due to its great abundance of spectral lines, should be particularly encouraged to be tried. This is in an electric lamp for therapeutic use by the Russian doctor

1) MAGNUS MÖLLER: The influence of light on the skin etc., Stutt. back in 1900.

2) German med. Weekly, No. 5-6, 1901.

it

from

EWALD') who, in 1895, believed to have made the observation that the workers in the ironworks at Kolomna (Moscow Government), who were engaged in welding iron together with the help of electric current, were spared from certain diseases such as rheumatism stayed. He therefore made a lamp, the positive pole of which consisted of cast iron, the negative of which consisted of a rod of carbon: a current of 2-300 amps was used. KOSLOFFSKI later used the EWALD lamp at a private clinic in St. Petersburg. The placement of the patients had to be done at a distance of 1.2 m from the arc, as the emissions from the melting iron were intolerable at closer distances. The parts of the patient which should not be treated were protected by screens. The séances were of 3-2 minutes and were followed by skin erythema.

The use of metals as high-current electrodes has now encountered practical difficulties because the metal melts

melts and spatters, so that the patient has to be placed at a great distance from the light source, which also makes it difficult to regulate the lamp. In May 1901 I came up with the idea of using water to cool the electrodes in order to eliminate these disadvantages. I had bought an X-ray lamp with a water-cooled anti-cathode for use in the Light Institute; it now made sense to try water cooling of the ordinary direct-current electrodes as well. Through the formation of an arc between two iron pipes through which water was flowing, it was shown that a quietly burning arc light with the characteristics mentioned below was obtained.

1) See KERNIG: Experiences about the effects of intense electric light. journal f. diet and physical therapy 1899, Vol. 2, p. 238.

By the way, a closer examination of the literature showed that W. SIEMENS had already used a water-cooled metal electrode in an arc lamp in 1879 . While the positive pole was made of carbon, the negative was made of a gold-plated metal capsule, the inside of which was cooled by a stream of water. This resulted in only a slight wear of the electrodes, which was necessary for the regulation mechanism of the lamp in question, but a change in the properties of the light by means of this cooling was not pursued. As I shall discuss in more detail later, it is also particularly when the positive electrode cools that the light changes its character.

The electrodes can be cooled in a number of different ways. At lower amperages (below 20 amps) I have hitherto generally preferred internal cooling, by giving the metal in question the form of a sleeve which can be screwed onto a double-walled pipe with water circulation. With larger currents it is more practical, in any case concerning the positive pole, to apply external cooling in such a way that the electrodes are placed in a vessel with flowing water in such a way that only their tips protrude above the water; in some cases it is advantageous to place the electrode tips just in the water surface, or even a millimeter below it, which changes the spectral character of the light, but does not prevent the formation of arcs. Under all circumstances, the coolant must act on the electrodes very near the pole faces; With regard to iron, the distance should not be more than 3 mm, for metals with better thermal conductivity it can be slightly larger.

The most striking effect of the cooling, as far as the positive electrodes are concerned, is observed by suppression, or at least a minimized "cratering". This is clearly seen when using cooled carbon. By suppressing the thermal Transient action at the positive pole face, instead of being crater-shaped, the carbon becomes convex, but with small, flat facets, as evidence of some more local action of the current at the point where the arc leaves the pole.Using cooled iron as the positive pole, the metal wears out comparatively slowly, disappearing in the form of iron oxide, but this disappearance is so slow that automatic regulation of the length of the arc in the forms of lamps hitherto attempted on this principle could be omitted of metals that are less easily oxidized, such as silver, the pole becomes extremely long eaten up.

In connection with the fact that the crater formation is so greatly reduced, there is the relatively low thermal radiation. With currents of up to 10-12 amps, one can touch the electrode a few millimeters from the arc without feeling pain, and can hold the hand at a short distance from the arc for a long time without gene. At a distance of 5 cm from an 8 amp. iron lamp, a blackened thermometer did not rise above 40" in repeated tests". With an ordinary carbon arc light, most of the illuminating as well as the warming rays emanate from the crater; this light is therefore in reality for the most part an "incandescent light" which is emitted by the On the other hand, the light emitted by cooled metal electrodes is predominantly a real arc light,

, since the electrodes glow only on the relatively small areas where the arc emanates from them. As a result, the character of the light is predominantly determined by the relevant vapor spectrum of the electrode metal.

So far I have mostly studied the light from the cooled iron electrodes. Since the spectrum of iron is so rich in ultraviolet lines, this circumstance becomes decisive both for the quality of light and for its application. The properties of most interest when discussing use against skin conditions are their skin irritating and bactericidal ability, as well as how deep they can penetrate tissues. As to the ability of the iron light to produce a light reaction on the skin, it is exceedingly great. Stay a few minutes at a distance of 1 m from a 25 amp. Iron lamp can produce light erythema in the skin of the face. If one exposes the skin of the volar side of the forearm z. B. 10 seconds of this light at a distance of 12 cm, an erythema develops, which is characterized as a light erythema in that it only appears a few hours after the treatment, leaving behind a pigmentation. The bactericidal properties of light are related to this. While an ordinary carbon arc lamp of 30 amps and 50 volts at the best angle of emission produces Staph. pyog. aur. in surface culture in 3 to 4.2 minutes'), a corresponding effect is seen at a 25 amp. Iron lamp reached in about 5 seconds (time is determined by illuminating a suitable cutout in a rapidly rotating disk).

1) We're talking about the "relative" kill limit here. See the following essay

A peculiarity of the ultraviolet rays is that they are so strongly absorbed by all matter, and on the whole the more strongly, the farther out in the ultraviolet part of the spectrum they are. At wavelengths below 2 = 2000, even water, even air, absorbs them strongly. Glass is only reasonably permeable to the portion of ultraviolet rays closest to the violet portion of the spectrum. In accordance with this, it has been shown that an ordinary object glass, about 2 mm thick, completely protects the skin against the action of the iron light which, without the glass, would have given rise to a strong reaction with the formation of blisters. It is even more difficult for ultraviolet rays to penetrate the skin. STREBEL found that concentrated light could not pass through a human ear compressed between quartz plates. In another experiment, a piece of skin, dissected free of fat, was clamped between two quartz plates and " irradiated, to the exclusion of all colored rays, with concentrated ultraviolet light supplied by induction sparks between zinc and aluminum electrodes." The object irradiated was 140 cm away from the spark;

a faint but very distinct gleam of light appeared on a fluorescent screen placed behind the skin . — FREUND") examined the absorption conditions in the epidermis by attaching pieces of burn blisters, pemphigus blisters and THIERSCH epidermis strips, first the 0.2 mm wide slit of a ROWLAND grating spectroscope. As a light source he used the sparks of a powerful RUHMKORFF, amplified with the help of a Leyden bottle Inductorium with electrodes of EDER's alloy (lead, zinc and cadmium) at a distance of 40 cm

1) Archive for Derm. and Syph. Issue 1, 1901.

from the column. FREUND came to the same conclusion regarding all three preparations; he found that beyond the cadmium line, y 3250 AE, ultraviolet light did not penetrate the

the pieces of epidermis had protruded in sufficient quantity to act on a photographic plate; as for the larger wavelengths, on the other hand, a certain quantity of the light passed through.

These experiments, which are interesting in and of themselves, do not provide any clarification of a quantitative nature, since one would have to know, among other things, the energy distribution within the spectrum in question; but one can still draw the already probable conclusion from this, that the ultraviolet rays, which lie closest to the violet rays, penetrate the epidermis comparatively better than those which lie further out in the ultraviolet.

To get a preliminary idea of the distribution of the bactericidal rays in the spectrum of iron, I exposed the light of a 25 amp. iron lamp pass through a spectrometer with lenses and prisms made of quartz. As the spectrum thus formed lies in a line which forms a very acute angle with the rays emanating from the prism, I resigned to examining the spectrum where it was perfectly pure, but brought up a surface culture

of B. prodigiosus perpendicular to the direction of the rays, at a suitable distance behind the prism, where the spectrum was sufficiently differentiated for my purpose. At this point the spectrum had a visible extent of 10 mm, while the ultraviolet, captured by a uranium glass, was about 50 mm long. It was now shown that with an illumination of 3-4 minutes the bacteria in a 6-7 mm

was.

were

broad band, the center of which was about 15 mm outside the extreme visible violet, while no effect was seen in the whole visible band of the spectrum and the next 10 mm of the ultraviolet

At three times the illumination time, the bacteria were killed or weakened over a 40 mm extension in the ultraviolet spectrum; but even with this illumination it was not affected by the ultraviolet spectrum in the whole visible spectrum and in the parts immediately adjacent to it. The rays which act most strongly on silver chloride paper, and those which produce the strongest fluorescence in uranium glass, are similarly distributed. The correspondence between these ratios is probably based on a corresponding distribution of the amount of energy in the short-wave part of the spectrum, but this can only be determined with the help of bolometric investigations.

However, this much emerges from the experiments, that the rays of iron light, which have the strongest effect on bacteria, lie fairly far outwards in the ultraviolet range. It is in good agreement with this that the effective parts of the iron light are subject to very strong absorption through the skin. The light of a 25 amp iron lamp acts on chloride of silver paper through a 1 mm thick, fat-free layer of skin (originating from the breast of a child about twelve years old) three times more slowly than it would at the same distance and under the same conditions with a 25 amp. Carbon arc lamp is the case. It is probably also the visible rays contained in the iron arc light that caused the slight blackening of the paper that gradually occurred. Through a 0.1 mm thick layer of the same skin on the epidermal side (microtome section of a frozen pre

parates), on the other hand, the silver paper was acted upon equally quickly by both types of light; this thin layer was apparently able to penetrate some of the ultraviolet rays. The fact that they are able to penetrate through the epidermis also follows from the strong vascular dilatation which they produce.

The peculiarities of the iron light, as far as we know them up to now, are as follows: relatively low heat emission, strong skin-irritating effect, strong bactericidal effect, very low penetration ability. A possibility of the clinical application of this light seems to be linked to these peculiarities. Where a superficial bactericidal and skin-irritating effect is desired, a good field of action must be found; against all deep-lying sufferings, such as e.g. B. lupus vulgaris, it is not suitable.

For preliminary clinical experiments I have made a small hand lamp of 8-10 amps and 40 volts; it is intended to be applied in toto on the diseased area so that the arc comes a few cm from the skin; it is provided with pressure quartz according to FINSEN. the

The small thimble-shaped iron electrodes must be replaced after the lamp has burned for 3-4 hours, as they gradually oxidize and disappear as iron oxide fumes. A disadvantage is the occasional precipitation of the smoke on the printing quartz, which therefore has to be dried off frequently. With this lamp you can produce a typical light reaction with the formation of bubbles with continuous lighting for 3-5 minutes. For the time being, nothing definite can be said about the duration of any therapeutic séances; just as little one can already set up specific indications for the application.

A direct comparison between the reactions produced by this little lamp and those produced after the use of Finsen's apparatus would be misleading; for as the light of these latter contains a large quantity of the rays which penetrate into the depths, the difference in the reactions after the use of the two kinds of apparatus is not only quantitative, but qualitative. The hand-lamp would probably be considered from the point of view that where an intense but superficial effect is desired, it can produce it in a considerably cheaper manner than has hitherto been possible; where depth is necessary, it should not be used at all.

About the effects of light on microbes.

II. An improved method of investigation.

Of

Sophia Bang.

In an earlier work ') I drew attention to the necessity, when investigating the bactericidal effect of light, to take into account that the nutrient medium in which the bacteria are located during the illumination constitutes an essential part of the applied absorb light. BUCHNER's method, improved by FINSEN, is the most accurate of those used up to now. Meanwhile, when the time of killing the bacteria is to be determined accurately, the objection to this method can be made that it illuminates the bacteria in a layer of agar, namely, as a suspension culture. Under these conditions, the bacteria lying deep in the agar are not struck by the light before it has been filtered through a more or less thick layer of agar which, like most other nutrient media, because of its yellowish color and other spectroscopic properties, absorbs in a special degree the short-wave rays, i.e. precisely those which are most effective against microbes. Small

1) S. Bang: On the Effects of Light on Microbes I., Communications from Finsen's Medical Light Institute II. Communications from Finsen's Medical Light Institute III.

Changes in the thickness of the nutrient, color and other properties can therefore affect the time it takes for the light to act to kill the bacteria. In order to reduce this unpredictable light absorption as much as possible, I used "hanging drops" with a maximum thickness of 0.05-0.15 mm in the work mentioned. The absorption of light by the nutrient medium was not entirely eliminated by this, but it was reduced to a comparatively small value, just as it also made it possible for the surrounding air to have a uniform effect. By also taking into account a number of other physical factors, it was possible to achieve reasonably constant experimental results, which was difficult using the older methods. It also showed that the killing of the bacteria occurred in a much shorter time than might have been expected from the previous results. This is easily understood since the microbes lying deep in a light-absorbing layer of agar can withstand longer illumination than those lying closest to the surface.

Dr V. BIE went a step further in the direction of eliminating the light absorption of food by using "surface cultures" on agar prepared by pouring a few drops of the bacterial culture in question onto a petri dish agar plate; by the use of a desiccator with chloride of calcium and dilution of air, the culture fluid dries to an even layer; if the surface thus prepared is now exposed to the light, it has no foreign matter of any importance to pass before it falls on the bodies that pushes bacteria.

Since this method is still a bit cumbersome

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and since such an energetic dehydration process hardly affects the life force of all bacteria, I simplified the method in such a way that I used a fine cotton brush (an iron wire wrapped with fine hydrophilic cotton, sterilized in a test tube) to paint the bacterial culture like this spread as evenly as possible onto the agar plate, which was then left to dry spontaneously. My assistant, dr. JANSEN later used a platinum eyelet instead of a cotton brush; This partly meant that one knew to some extent how much of the crop was sown, partly the surface dried even faster by itself in this way, after just 2-3 minutes. "Drying up" only means that there is no free, mobile liquid on the surface; as for the agar itself, it retains its moist consistency and is kept in a moisture-saturated atmosphere during and after the experiment (see below). The possibility cannot be entirely denied that this method may have some influence on the resistance of the bacteria, particularly when dealing with species which are particularly sensitive to desiccation. But as long as no experiment is made with such species, and as long as we are only talking about comparative experiments with one and the same species of bacteria, this circumstance will not play any demonstrable role.

One can be convinced that the bacteria really do remain on the surface of the agar without penetrating into it, when they later have grown so far that the colonies are visible to the naked eye, which in each individual case, as for the bacteria studied so far, keep entirely superficial; partly, as regards the tubercle bacilli, by hardening a plate thus seeded, and by making a perpendicular microtome section through it, I have directly convinced myself that the bacilli lay in a thin, even layer on the surface, without the penetration of a bacillus anywhere through to see the surface of the agar layer.

Illumination of surface culture can be done in a number of ways; The use of gradual illumination is practical and particularly time-saving. This method was used in 1893 by Ward') who illuminated the suspension culture in the agar through square or circular "windows" which were covered one after the other during the illumination. A similar procedure was used by FINSEN, independently of WARD in his first experiments on the bactericidal effects of light, 2) in that, in addition to the procedure published at the time, he also used the following, which he himself describes as follows: "The plate cultures in a NIELSEN flask are exposed to the light that after a minute a small field of the plate culture is covered with a piece of paper, after 2 minutes a new field, after 3 minutes a third field, etc. The pieces of paper glued with fish glue were black on the side facing the bottle, um to prevent penetration of the light, and white on the side facing the light to prevent a heating effect. On the white side the number was written to indicate the time during which the field in question had been exposed to the light. When the bacteria grew out and the pieces of paper were removed, a mosaic was revealed, caused by the different effects on the different fields, and one could now read how long the light had taken to kill the bacteria. Later the method was modified in such a way that the whole bottle was covered with the same kind of paper in which a lot of round holes were cut; after the bottle had been exposed to the light, the holes were covered in succession and at definite intervals of time; this made the effect of the light stand out more sharply, in that each field was now surrounded by a culture completely unaffected by the light, while the surroundings were therefore simultaneous as a control. These methods are used with unconcentrated light."

1) Marshall WARD: Further experiments on the action of light on Bacillus anthracis and on the Bacteria of the Thames. proc. of the royal Soc. of London, Vol. LVI, 1894.

2) FINSEN: On the use of concentrated chemical rays of light in medicine. 1896, pp. 28-32.

I combined the use of gradual lighting with the use of the above-mentioned surface culture in such a way that I let a flat "shade generator" move past the cultures at certain time intervals. Instead of taking a preparation, e.g. B. 1 minute to illuminate a second specimen 2 minutes, I illuminate a larger area of the surface culture 1 minute, then move the shader forward one step, with a corresponding strip of the culture being protected from the light; after a minute has elapsed I now advance a new stage so that there are now 2 strips in total in the dark etc. While the first use to find the effect of 1-10 minutes of illumination, an illumination time of 1+2+3... +10 min. = 50 minutes apart from the preparations for the individual tests, the same examination takes place

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The second method takes only 10 minutes in all, and only the preparations required for an experiment are necessary. To this comes that it is of course easier

is, the light source 10 instead of B

55 minutes constant G

keep.

The accompanying schematic drawing shows the arrangement of the apparatus in which the illumination takes place. The brass plate ABCDEF has a circular cut-out MNOQP, which is closed with a plane-parallel quartz disc, behind which the surface culture is attached. The shadow giver OK, be

stands from a thin brassD

plate with a long stem G, which is screwed around the pivot H with the help of the screw L

can be rotated. This QR

if you push the shadow giver к

such that its edge

OP to the right or to the left, N

directly in front of the QuartzE

F disc Rwandt. The size Fig. 9.

one reads along with the advance

using the G pointer. With the shader advanced as far to the left as it can come, the edge OP touches the small plate MN, which constantly shadows part of the quartz disc; the corresponding part of the culture is used for control,

P

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Is the shade provider as far to the right as possible. pushed, he still shadows a part of the quartz disc at Q, also for checking purposes. At U is a tube through which species of air whose action it is desired to examine may be introduced into the surface of the culture (a similar tube is outside at Q).

Figure 10 shows a vertical sagittal section through the lowest part of the apparatus. TT is the brass plate on which the whole thing is mounted. SS is the shadow giver. At X the quartz plate is visible. VV is a circular dish in which the agar plate (y) seeded with surface culture rests on a glass plate S. At VU sees

the pipes, through which different types of air may be supplied. The culture dish TV is screwed into the apparatus and is fitted with a rubber ring (g) to make it airtight and watertight. Usually the whole apparatus is turned into

SA attached to a "photocteinometer" of the construction explained in my work cited above, Fig. 10. As I have made a small modification of it in a special respect, I give a sketch of it in Fig. II, giving up as far as details are concerned refer to the description given The metal box ABCDE is placed in front of a light source in such a way that the light rays strike its surface at right angles (if it is an ordinary electric arc lamp, it is best to place the box at an angle of 50° with the Ax of the coals.) The container is under ordinary circumstances

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filled with boiled, distilled water, which is kept at a constant temperature with the help of the water-carrying lead pipes RR and the stirrer P. The shading device HHH is placed in the backdrops 31. The light penetrates into the container through the glass disc MN, passes through the plane-parallel liquid layer between this and HH, and finally reaches the surface culture through the quartz disc X (see also FIG. 10).

The only obstacle that the light beam encounters on its way from the light source to the bacteria, apart from the air, is the two flat quartz plates and the flat liquid lying between them. In order to be able to vary its thickness in a certain way, the foremost quartz disc, MN, is attached to one end of a tube KNMK, which can be screwed into and out of the ring 00. The thickness of the liquid can be read off the measuring stick F. With SS, a diaphragm may be employed if necessary to prevent reflection of light from the sides of the tube, which, incidentally, is opaque, as is everything inside the vessel

from

is black. With the help of the cover G is opened and closed for the light.

In order to possibly compare different test results with a common standard, I have provisionally and purely arbitrarily determined the following test conditions as "normal test".

As a source of light I used an electric arc lamp of 30 amps and 50 volts; I regulated the current with an accuracy of 0.1 amp with the help of switchable light bulbs. The positive coal has a diameter of 24 mm, the negative one of 15 mm. (One of the difficulties in reproducing the same level of light using such a lamp is that the nature of the charcoal can vary). By using projection images of the arc in different directions, one ensures the burning of the crater with a regular shape. The photocteinometer is set up in such a way that the rays striking the center of the quartz window make an angle of 50° with the axis of the carbon. The distance between the closest point of the crater and the surface culture is 60.5 cm,

which corresponds to a distance of 60 cm without a water layer, as this is 2 cm thick.")

Up to now I have used Staphylococcus pyogenes aureus in a 20-hour broth culture, fully grown at 37°, as test bacteria. They were filtered through ordinary sterile filter paper, and then diluted with 2 parts sterile broth. From the broth diluted in this way, which appears cloudy to the naked eye, a suitable amount is transferred in the manner already mentioned, using a cotton brush or a platinum loop, to the surface of a sterile agar plate, preferably prepared a few hours before. poured forth into the culture dish. As soon as the layer of liquid has dried sufficiently, the bowl is screwed into the shading apparatus, and this is placed in a "photocteinometer," which should preferably contain a liquid of at least 280, which is the safest way to prevent fogging of the quartz discs. After the gradual lighting has taken place, the removed culture dish is placed in a Petri dish lined with moist filter paper, which is placed in the thermostat, preferably at about 34", at which temperature it is easiest to avoid the formation of so much condensation water, that it can drip down from the lid of the Petri dish onto the surface culture.

After 24 hours of standing, the culture has an appearance such as B. Fig. 12, which is reproduced from a photograph.

1) See the cited work p. 16.

On the right and left you can see 2 crescent-shaped areas with strong, confluent bacterial growth; these are the unlit control sections; between these games, 10 strips or 1-10 minutes received lighting. To easily read the location of these strips

be able,

holds

a glass plate in front of the surface culture, on which the graduation lines are drawn, corresponding to the individual stages of the shade giver. The strip furthest to the left

to

man

has been exposed to illumination for one minute.

A weak light effect is already evident here in that the strip can be distinguished from its surroundings at all; one more

a somewhat stronger effect can be seen in the next strip, which has been illuminated for 2 minutes. In the third strip (3 minutes light) you can see a clear decimation and in the fourth strip (4 minutes light) the number of colonies is so small that the individual colonies can be counted (approx. 50). In the sixth there are four colonies, in the seventh 5, in the eighth 4, in the ninth 4, and the next strip which is 10 minutes

has been illuminated has only one colony. So after 10 minutes of illumination we still did not reach the absolute kill limit (by which I mean the point at which even the most resistant individuals are killed; this can be seen in a second experiment, Fig. 13).

Here 12 strips are lit such that the leftmost strip is 6 minutes, the next is 7, and so on up to the 12th strip which is lit for 17 minutes

approx.

became. The number of colonies in each strip is

10, II, 2, 6, 4, 2, 3, 2, 0, 0, 0, 0. So with the 14th minute the absolute kill limit seems to have been reached. But it is only very approximate and conditional that after such an attempt one can set the absolute kill limit at 14 minutes; for where this limit is located depends, among other things, on the number of bacteria sown on the unit area.

An apparently sharper border is seen after 4 minutes of illumination (Fig. 12), where the number of colonies has become "countable" while the colonies in the

preceding strips are so numerous that they flow together. The position of this limit, which I want to call "the relative killing limit" just to have a name, has now also been shown to depend on how many bacterial individuals are seeded on the agar surface for the unit area. This can be determined by experimenting with different degrees of dilution of the same culture, such as in the following series of experiments:

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Tribe-
Culture

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Dilution 1:3 dilution 1:9 dilution 1:18

1:36

about 50K. Strength

Decimy1

tion 22K. about 50K

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Lighting Level Level Strength 3 min Decime Decime Decime

ration ration bel. 3'2 " Strong strong

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about 50K. about 50K

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So we find no sharp cut-off for cultures of Staph. pyog. oh,

The conditions here are very similar to those I demonstrated earlier with regard to B. prodigiosus with the help of the drop method, namely an increasing decimation with increasing exposure to light: With these, as well as with a whole series of bacteria investigated later, it has been shown to be constant within certain limits that the longer exposure to light lasts, the lower the percentage of bacteria that can resist it. But it seems that this "decimation curve" has a different location, and perhaps a different shape, in the different species of bacteria, as a sign of the different ways in which the unequal resistance of individuals to light is manifested in the different species. I shall We will not go into detail about these conditions here, since they are currently being made the subject of special investigations.

On the present occasion, I wish only that

To illuminate the usefulness of the method of "biological light measurement", i.e. to determine the relative ratio between the richness of different light sources to bactericidal rays or the permeability of a light filter for such. It has now been shown that for many practical investigations of this kind one can use the position of the "relative killing limit" mentioned, i.e. the point in the culture where the bacterial colonies have become "countable" instead of "uncountable" (approx. 50- 100). In 11 trials with Staph. pyog. aur, to the one described

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" normal" manner, the limit was 4, 3'2, 4, 312, 3, 4, 3'2, 412, 4'2 minutes, averaging 394 minutes, with a margin of 3. minutes or 20% on both sides.

This is true when the experiments are made at different times; the lack of exact agreement is due to the difficulty of obtaining uniform cultures. Much greater accuracy can be obtained, as I shall show below, by comparative experiments carried out simultaneously or in immediate succession with one and the same culture of bacteria.

In the meantime, the discussed accuracy of 20" is already sufficient for many practical experiments, since it is often sufficient to get approximate values, among other things because the different light sources that are desired to be compared often differ so extraordinarily in terms of luminous intensity give a few examples While a 30 amp arc lamp at 60 cm distance, as mentioned, gives an average of 3.2 minutes of relative kill, the same result is achieved at the same distance in about 4 seconds using an arc lamp with the same amperage, but the positive pole of which is a water-cooled iron rod Direct sunlight took over an hour on August 21, 1901, between 11-2 o'clock (in Copenhagen) to produce the same effect (see Fig. 6, where the position of the shade provider is changed every quarter of an hour, so that the shortest illumination lasted 1 hour and the longest 3 hours).

As an example of the greater accuracy when making comparative experiments with one and the same bacterial culture, I can mention that repeated experiments on the whole 6) consistently succeeded in demonstrating the difference in the absorption which the light undergoes when it shines once, e.g. B. 2 cm distilled water, the other time passes an equally thick layer of ordinary water. While the relative kill limit in this way was found to be 3/2 minutes when the tube KMNK (Fig. 3) was screwed in so far that the light had to pass only 1/2 cm of distilled water, it was on the contrary when the apparatus was filled with ordinary water at 5 minutes. Was got the thickness of the water layer 3 cm

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Bel. 3 min stke.Decrg. 'Schw.Dezg. black Dec. Hint 3'2.,, about 50 K. Decimirg.

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8 pcs. Dec. approx. 50 K. pcs. December 5

7

approx. 50 K. 28 pcs. Decrg 5'2 ,

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IO about 50 K. 6

3

one has a kill limit at 4', min. for distilled water, at 5/2 minutes for ordinary water.

From this one can see how important it is to use water that is as clear as possible in the light filters of therapeutic apparatus. And it is therefore no wonder that the absorption of light which takes place in the nutrient media usually employed reaches a very considerable magnitude. To examine this more closely, I filled the "photocteinometer" with bouillon instead of distilled water. I used a light-colored veal bouillon, which corresponds almost exactly in color to a 1/4% solution of dichromated potash; by a

thickness

2

cm

layer of this broth, I illuminated a surface culture for 2-24 minutes without getting any apparent effect of the light; the experiment was repeated after diluting 1 part broth with 24 parts distilled water, again completely negative after 24 minutes of illumination. Only when the broth was diluted with 48 parts water and the thickness of the layer reduced to 1 cm was the relative kill limit reached after an illumination time of 60 minutes. The layer of diluted bouillon used would correspond approximately to a 1/2 mm layer of undiluted bouillon. The light used in the experiment thus took 1 hour to exert the same bactericidal action through this layer as it took 3-42 minutes if it were was passing through 2 cm of distilled water We have here direct evidence of the need to eliminate the light absorption of food substrates when studying the effect of light on bacteria.

Finally, I thank Dr. JANSEN for his valuable and tireless help in elaborating the details of the method.

The treatment of smallpox with exclusion

of the chemical rays of daylight.

Of

Niels R Finsen.

Two colleagues, district doctor Dr. CANCER in Vordingborg and city doctor Dr. LUNDDAHL in Aarhus, have been kind enough, at my request, to give me information on some cases of smallpox which they have treated in the red light, with permission to publish them, for which I hereby express my warmest thanks. dr KREBS has a case, Dr. LUNDDAHL over 9, partly light. Though these cases mean little on their own, they add importance to the series of observations already available. Smallpox is, at any rate, such a rare disease here in this country that one must be thankful for every new observation of the effect of its treatment with the exclusion of the chemical rays of light.

District doctor Dr. CANCER writes the following:

" On Sept. 4, 1900 I received a smallpox patient for treatment; smallpox broke out on the third. Only on the 6th was the patient interned in a felt tent with red cotton cloth in front of the windows.

The case was of a serious nature and the exanthem would receive communications from Finsen's Medical Light Institute III,

8th

would certainly have become confluent, not only on the face but also on the other parts of the body, had the patient not been treated in red light. (He had 108 smallpoxes on his right hand alone, and "there are almost none here compared to the other body," the patient said.)

When he came into the red light, many nodules had become blisters and some had become pustules, especially on the face. An hour later the tickling and stinging associated with smallpox, the heat and tension in the skin, began to subside, and by the next day the swelling had subsided significantly. Neither blisters nor pustules developed further. There was neither suppuration nor suppuration fever.

Instead of the ugly brown and gray spots, which are known from earlier times, there remained a number of bright pink nodules, which could be pushed off with the finger, but soon after the pressure had ceased filled with blood from profuse vascularization. A number of puncture marks remained on the face, no real pockmark.

To me, who in the past I have seen large numbers of cases of smallpox several times, the mild course under the treatment in red light must have come as quite a surprise, and the treatment certainly deserves to be carried out consistently in the future, wherever the disease should show itself, because, in my opinion, it claims great and far-reaching importance.

Herr Stadtarzt LUNDDAHL wrote to me on November 7, 1901:

" By agreement, I hereby send you a brief summary of my smallpox cases, especially with regard to their treatment in red light and their results."

No. 1. 5 year old girl vaccinated with good success

in the incubation period. Distributed varicella-like eruption. Only observed later in the course of the disease, since distributed infiltrations with tough, resistant scabs had formed, it took a long time for them to fall off, leaving scars which were quite superficial. Not treated in red light.

No. 2. Boy, 7 years old, unvaccinated. Severe initial symptoms. Ill April 15, 1901. April 16-17 A papular exanthema appeared in April. Hospitalized on the 17th. 3 double layers of red shirtings in front of the windows; the room became very dark as a result. During the tour, daylight was let in for a very short time. The rash spread and became vesicular; at the same time the temperature fell, but the unfavorable general condition remained. Between 22.-23. the suppuration began, the temperature rose a little in the morning (about 38), in the evening it had been 38 to 38.5. Confluency of the exanthem, coherent scab over large areas, with squelching pus.

with squelching pus. Decomposition with disgusting stench. On the 24th temperature 40. Death on April 26th.

This case had proved to be a very difficult one from the very beginning. Although the patient was placed in the "red room" even with very little light applied at the onset of the disease, the disease was apparently unaffected. The only effect might be that there was no high fever at the beginning of the suppuration stage. It only occurred when the pus started to decompose.

No. 3. 4-year-old girl, sister of the previous patient, vaccinated immediately after the outbreak of the disease, without success. Exanthema began weakly on the 18th, quite advanced on April 19th. Laid in the same room as the brother on the morning of the 19th. The general condition was very bad, but in the first few days without a high temperature. The rash spread everywhere but did not become confluent; between 23.-24. the contents of the vesicles began to turn yellow, at the same time there was a slight increase in temperature (38.4 in the morning), but the next day the general condition suddenly improved. 25-26 the pustules began to dry up into looser, less coherent crusts, which soon fell off, leaving large, red, round patches, especially on the uncovered parts of the skin, which lasted a long time, on the face also a number of rather small and superficial scars formed. On May 4th, the red light was eliminated. The rash itched very little.

No. 4. The children's mother was attacked so lightly and with such insignificant rash that it was not worth treating her in red light.

No. 5. Her newborn, 3-week-old child was seized at the same time as the mother (vaccinated shortly after outbreak, unsuccessful). In the beginning only very sporadically widespread exanthema, here and there individual blisters and apparent well-being. Only after the illness had lasted about 8 days did vesicles appear to a greater extent, coalesce, and finally almost the entire surface of the body was a suppurating area. The child died on the 28th. When the exanthema erupted more severely, red curtains were hung around the cradle, but for the first few days, when the eruption was very slight, nothing had happened in that direction, which also proved to be a mistake.

No. 6. A 51-year-old washerwoman. Infected by the aforementioned family. Ill since April 25th. At the

Morning of the 26th widespread, papular, measles-like exanthema, temperature approx. 41, general condition bad. The same day in the morning first taken to a room with red window curtains, later to a room with red panes. The same evening the temperature was 38.8, and in the next few days it became normal. Isolated vesicles formed on the widespread initial rash, but the bulk of the rash disappeared without a trace. The general condition improved very quickly. The vesicles quickly dried into small, tough pieces of scab, leaving behind some smaller infiltrations, and in the palm of the hand a few small bleeds under the epidermis. On the whole, therefore, the exanthema took a completely abortive course. She stayed in the red room for about 13 days. Significantly more light came into the room through the red panes, which were used in the future, the patients could see and read, work, and were generally well in this light - there was never a particularly strong longing to get away from it. Whether the great amount of light that came in

it was, moreover, in the very brightest spring months - it is to blame that none of the patients, even the most easily affected, entirely escaped the scars, which, however, were not very deep and will certainly later be almost visible, I cannot say. (The scars were only on the uncovered areas of the skin.) But even if it were, perhaps most patients would prefer such a lighter "red room" to a dark one, even at the risk of getting some small scars on their face. I don't think that the patients should have secretly let the daylight in. They were too interested in treatment for that, and feared harm by infringement,

U.N

No. 7

A 7-year-old girl vaccinated with good success during the incubation period. Ill since May 2nd, eruption on the 3rd, on the 4th very extensive exanthema with yellow, pus-like contents. The general condition was very little affected, temperature not above 38 since admission on May 4th. Drying-up occurred quickly with a light, loose crust and scales. Hardly any itching. Lay in the red light from 4-18. When discharged in mid-June, large red spots all over the body. Small scars distributed on the face.

No. 8. 65 year old woman, not vaccinated since childhood. Sick May 4th. The next day widespread vesicular eruption, which increased in the following days, became confluent on the inner thighs, and was very dense on the whole. Also strong mucosal eruption. The temperature, which was 39.6 on admission, fell rapidly, was already 38 the next evening, May 5th, stayed low for the next few days, but rose to 38 on the evening of the 8th and on the morning of the 9th, there in the heavy and widespread eruption the contents of the vesicles became purulent. Drying started early, on the face in the form of tough, dark scabs; on other parts of body as scales and soft, yellowish crusts, mostly just flaking. The mucosal eruption disappeared very suddenly. The general condition was good after the first few days. Was in red light for a good 14 days. Slight scarring of the face, as in the previous cases.

No. 9. One child died of purpura variolosa one hour after admission.

No. Females 10 and younger, not vaccinated since infancy, with slight variola discreta; Transitional form to the varioloids. Each of them was observed in the house for about 4 days. Treatment in red light for about 10-12 days from admission, the vesicles dried into small scabs or disappeared entirely, leaving small red spots. A few of them left scars on the face, similar to those described earlier.

No. 12. Younger female (30s), ill since May 15, papular eruption on 17th, vesicular eruption started on 18th.

High fever and severe initial symptoms; the rash became very widespread. Strong mucosal eruption. Taken in the morning of May 18th. The general condition was poor in the first few days (she was five months pregnant at the same time), significant improvement on May 21st. At this time, some of the vesicles began to acquire yellow content (no particular rise in temperature corresponding to this stage). The course of the eruption was as follows: on the forehead the vesicles dried up into small crusts, in the rest of the face the contents were absorbed and papular infiltrations remained. On the body, and especially on the lower extremities, the vesicles filled with yellow content, which has now also been resorbed , in some places small, yellowish, loose crusts formed, in most places only scales. The mucosal eruption suddenly disappeared. she was

14 days in a red room. On discharge on June 28th, the face was densely covered with red spots, and numerous scars formed, especially on the forehead, denser, but not deeper, and no larger than in the previous patients.

No. 13, 14, 15. Two younger women and a small child, all from the countryside, arrived so late and with such mild cases that red light treatment was dispensed with.

Regarding the effect of the red light treatment, one could perhaps say that at No. 2 had no special meaning. that no 3 took a good course can perhaps be attributed to the treatment. Whether No. 5 would have been saved if the treatment had been carried out from the beginning is doubtful in view of the young age. No. 6, in which the disease began quite violently and progressed abortively, and no. 8, in which it took a very good course despite the violent beginning and extraordinarily widespread exanthema, and no. 12, where there was also a very widespread eruption, and where the condition in the first few days proved to be very serious, one may also count among the good results. Whether the red light treatment has any significant significance for cases no. 5, 10 and i cannot be decided."

When I received these case reports, it seemed to me that the results, both as to the whole course and as to scarring, were less good than they tend to be in treatment in the red light. Since in journal no. When it was mentioned in Chapter 2 that the daylight had been allowed in for a short time during the tour, I suspected that the less favorable results might have been due to an equally short time daylight being allowed in. I wrote about this to Mr. LUNDDAHL, the city doctor, and asked for information on this question, since she was of particular interest, because one does not really know anything specific about how much light or how long exposure to daylight is sufficient to cause damage. -- In addition, I asked how the pockmarks of the patients were now, six months later; experience shows that even if the patients have small scars when they are discharged after red light treatment, they disappear after a short time because they are very superficial.

City doctor LUNDDAHL showed me the kindness to immediately examine the patients again, whereby it turned out that “only patient no. 3 could be called pockmarked to some extent".

With regard to daylight, I received the following information: “Daylight was let in for all patients during the rounds. With regard to the first two, the curtains were pushed aside a little, with the others the windows were ajar. There was never any question of a longer exposure to daylight, a lot can be seen during 1/2 minute and I don't think it lasted longer each time. On the other hand, it can still happen a few or more times a day. Due to the circumstances, there could not be a specific tour time here, so that the patients could be demonstrated at specific times; but the local colleagues could go in if they felt like seeing the patients. As a result, the patients were possibly exposed to daylight several times, but probably for a shorter time.”

This information is of much interest, and gives greater importance to these case reports, as we seem to have here a strong reassurance that even very short exposure to daylight has an injurious effect, and is to be avoided. On the other hand, the application of a stearin lamp or an ordinary kerosene lamp will not entail any disadvantage for the patient. It may even be possible to leave a stearin light or a kerosene lamp on all day without harm to the patient, as there are few chemical rays in such light. But the opportunity to experiment with this presents itself yes rarely. A series of experiments by which

, it was examined and determined what artificial light, and how strong artificial light, the small-pox patients could tolerate without suffering suppuration, would be of great importance, partly because some people seem to have an aversion to red light, and partly because the treatments hereafter are carried out everywhere could, even if one did not have red panes, or red window curtains.

Incidentally, I would like to point out here that now that the method has completely passed its test, it is to be regarded as the first duty of the doctor, as soon as the diagnosis of smallpox has been made, to see to it that in one way or another the windows of the sick-room are hung up tightly, and the light is kindled. When treatment can be arranged so easily, it is actually irresponsible to leave patients exposed to daylight until they can get into red light in the hospital; the more chance there is for the patient to avoid suppuration and its consequences.

he

Treatment of the rose with the exclusion of chemical rays

# of daylight.

Of

Niels R Finsen.

When I published my treatment of smallpox with the exclusion of chemical rays of light 8 years ago, I emphasized that this "is not a specific treatment for smallpox, but a new therapeutic principle, which could probably be of importance in other exanthematous diseases and skin diseases". I pointed out how interesting it would be to get clear as to whether or not the chemical rays have any influence on these diseases, and emphasized how easy and at the same time harmless it would be to make such experiments, e.g E.g. with measles, scarlet fever and rhinitis I made some effort at the time to get such experiments going, but as I encountered some difficulties and at the same time was ill and not very able to work, nothing came of it, and I therefore limited myself in part on some statistical studies to see if the course of said crane summer and winter there was a difference, partly due to suggestions as to how trials and controls should be made.

throughout

only

it

around

Some time later, Corps doctor Dr. medical KIER, who at that time was senior physician at the garrison hospital, kindly offered to make experiments with this treatment in his department. Since there were just a few cases of rose, we started with this disease. At my request, Dr. KIER did the treatment myself, I only helped with the installation. There were

7 cases

treated by Rose, since Corps doctor Dr. Kier's term of service was just about to end, and the new senior physician did not care to continue with the experiments. Since it seemed to me that there were too few and little pronounced cases,

to be able to conclude anything specific from it, neither positive nor negative, they were not published.

Now, quite recently, a communication from Dr. KRUKENBERG, Senior Physician in the Municipal Hospital in Liegnitz, on the treatment of several cases of rose in red light. As a result, our 7 cases as a supplement to those of Dr. KRUKENBERG received some value. I now have permission from Dr. KIER and the current chief of the garrison hospital, medical officer Dr. medical BJERRING, to be allowed to publish the same and hereby express my sincere thanks to both of them.

In order to avoid any misunderstanding, I add that it is not my intention through this publication to make an attempt to convince Dr. KRUKENBERG to take priority; but as these 7 case reports do not show such favorable results as Dr. KRUKENBERG, it seems to me that there is a special reason, indeed a certain obligation, to publish them now.

I bring first a presentation of the paper by Dr. KRUKENBERG, which Dr. JANSEN is to be owed, and then Dr. KIERS Medical Reports.

it is

HERMANN KRUKENBERG: Traitement de l'érysipèle dans la chambre rouge". Revue Internationale de thérapie physique.

1. Février 1902. The author, who is chief of the Commune Hospital in Legnica, treated a number of Erysipelas in the red room during the year 1900, prompted by an article by Dr. Bie in “Therapist. Monthly H.”, where a collected description of the entire FINSEN phototherapy, both the “negative” and the “positive” is given.

Right at the beginning of the article, Dr. K., having received the opinion that this treatment has a very beneficial effect on the disease and adds the remark that Dr. Roemer at the same hospital, also used the method successfully. But on the other hand he himself emphasizes how difficult it is to be able to say anything for sure after a single, rather short series of observations. Especially when dealing with a disease like Erysipelas, which can be very capricious in its course and sometimes cured spontaneously in a few days, giving rise to the superstition that the rose can be cured by "talking"

dr K. had the opportunity to apply the treatment to 13 people. If one calculates the recurrence as independent, one gets a total of 18 cases. There were 15 erysipelas of the common type, 3 were located partly on the body, partly on the lower extremities. All the patients were taken to a red room shortly after the onset of the disease, and with the exception of the first three, who were given some alcohol poultices, none were treated different treatment, neither in nor out

memorized, applied. dr K. does not seem to have treated other rose patients in the usual way at the same time. It would have been a somewhat safer starting point for evaluating the new treatment than, as Dr. K. to point out that the average duration of facial erythema can be normalized to at least 1 week; for the Erysipelas in Liegnitz could have been particularly benign at the time when the experiments were carried out.

The observations that Dr. K. made while treating these 18 cases in the red room are as follows:

The fever usually lasted only 2 days. It often stopped the day after or at the latest 2 days after the patient was placed in a red room. Only in 2 cases was it different, but in one it was due to pneumonia, in the second it seemed to be due to poorly executed exclusion of the harmful rays.

This had otherwise been done with care that could not be praised enough. A sick-room of the epidemic department was completely transformed into an exquisite photographic darkroom: the ruby-glass windows, walls and floor painted red, lamps like those which photographers use, with red glass and coating; even the surrounding rooms: corridor, antechamber, toilet and bathroom were red

man

Window. In this truly "red room" 14 of the cases were dealt with. Of the remaining 4, 3 lay in complete darkness and also gave good results, while i and that was the one to which I referred above in very unfavorable circumstances, namely in an ordinary room with 4 windows, which were well covered, but which after what dr. K. found out later that they were open when cleaning up in the morning. In this case the fever lasted for 6 days with a temperature between 39 and 40°, the disease spread and the general condition was bad.

In discussing the arrangements, Dr. K. how often one encounters complete misunderstanding of the whole thing. There are people who believe that the treatment with red light is that

just throwing a few rays of red light on the patient's diseased areas, similar to how one might give a steam shower. dr K. observed the following in a place where he had advised a red room: The patient lay in his bed in a sea of sunbeams, while a lamp with red glass was burning at his side. And this was also with a doctor.

With regard to the exanthem, Dr. K. that the initially sharp borders disappeared in the course of 12 hours and progression stopped. A slight reddening and swelling often persisted for several days. The formation of vesicles and squamous desquamation of the epidermis did not occur, as was often the case in the past. The process often ended in fine flaking.

There were five recurrences in all, but none of the recurrences occurred while the patient was in the red room. Only after the patient had come into ordinary daylight did it come on; 2 times even on the same evening the patient was discharged,

Complications noted were only pneumonia in one patient, severe headache and lassitude in the patient who was so poorly treated.

It would have been desirable if the author had stated how the patients were in the red room. The matter is still so new that any information on this is of value.

At the end of his article the author tries to find a theoretical explanation for the treatment. Could it be possible that Streptococcus erysipelatis thrives better in the light than in the dark? No, this contradicts the numerous experiences about the bactericidal effect of light and some experiments which the author himself made. (Here at the Light Institute we have also done some experiments with streptococci. They had no particular resistance to light.) Rather, as FINSEN said long ago, it must be assumed that it is the skin-irritating ability of light that causes the rash gives. And just as FINSEN spoke about smallpox, Dr. K. that some of the remedies used up to now on the rose probably only work by shutting out the light (such as ichthyol, tincture of iodine, etc.).

In a very interesting way, the author draws attention to some experiences of Negro pathology. According to DAEUBLER and Plahn, erysipelas and phlegmon are very rare among negroes, and that this is something peculiar to negroes and not to be ascribed to the peculiar climatic conditions seems to emerge from a communication from the hospital in Dar-es-Salaam (in German East Africa), where both Europeans and Negroes. One never observes Erysipelas in the latter, quite often in the former. Possibly it is the pigment of the Negroes which protects them against said disease.

I want to reproduce here in extenso the brief case reports that accompany the treatise.

1.

FW 24 year old nurse. In the past year twice facial rose, which 6 resp. lasted 5 days. Got

1./4 1900. Rose on the nose, half part of the left cheek and part of the forehead. evening temp. 39.6.

Red room.

2.

23./4.

2.4. 1900 AM: 38.5. No propagation. Free of fever in the evening. redness disappears.

AS 15 years. Had been in pain for 4 days and was a little swollen in the face. Recorded 21.4. Erysip. almost all over the face. 38.3.

epithem. alcohol. red room,

22.4.

37.2*)

erys has reached the hairy part.

38.3

36.8

well-being

36.6 3rd BJ 19 years. Had redness, pain and swelling on right leg for 3 days with no proven cause. Recorded

31.4. Characteristic erys, on right leg with irregular borders; scarcely perifies to the foot, central to the knee. 38.0.

Ep. alcohol.

376

1.5. Erysip. has spread to the foot.

Red room.

2.5.

no propagation,

39.3

38.2 83.5

.

3.5.

37.2. 4.5. Temp. below 37. The swelling goes away.

37.5

4th CP 25 years. rec. 20.4 due to sycosis.

Temp. above the line, morning —, below the line, evening temperature for the day in question.

2nd/5th 40. Erysip develops. on the left cheek.

Red room. 3rd/5th-6th/5th morning temp. approx. 39o. evening temp. circa 40. Erys. extends all over the face. general order bad.

7./5.-8.5. The fever drops a little.

9th/5th The fever rises. Right-sided pneumonia, bloody sputum, etc. Swelling of the face disappears.

12/5 fever free. well-being except for some stitches in the side.

5. AM 54 years. insane. Unwell for 3 days: fever, swollen nose. Recorded 18.15. 39o. Erys, on nose and left cheek to ear.

red room,

374

19./5. 20./5.—21.5. under 370. Swelling going down.

38.6

22.5. morning: sunlight. evening 39o. relapse.

Red room.

23./5.

371

36.7

25th/5th Daylight.

6. PS 55 years. Treated for several months for glandular tuberculosis on the right side of the neck and in the axillae. 12.6. evening temp. 38.5. unwell. 13.6. It shows erysip. starting from a fistula and spreading over

right side of the neck and part of the cheek. evening temp. 39.6.

Red room.

The whole

38.8

14.6.

Erys, spreading to right side of face. 39

15.6. cessation of fever. Still feeling unwell. The swelling only stops on the 17th/6th. on. Daylight.

7. OW 15 years. Said to be Erysip a year ago. had fever at 8 days. Has erysip over almost entire left side of face for 2 days. had since it is inserted. 15th/10th 38.6

Red room. 38.2

37 6th/10th Erys, up to the ear. 17th/10th 38.0

37.6 The following days below 37°. The swelling disappears. 20th/10th Sunlight. 26./10. towards evening fever: 39.1. Recurrence on the left cheek. Palm-sized blush.

Red room. 27/10-28 10. Intermittent fevers,

10/29 Cessation of fever. But there is a slight swelling all over my face for a few more days.

8th MT 25 years. Has had redness and pain from nose and swelling of face for 8 days. Recorded: 5./11. erys the entire right side of the face.

Red room.

6. II

37.0 The swelling goes away. 7th/11th fever stopped.

37.7

9. PW

31 years. Lay on the eye dept. because of corneal ulcer. At night between 29./11. and 30./11. facial pain.

1. 12. Added for rose, which covers almost the entire face. 39.9o.

Red room. 2nd/12th evening temp. 39.3 degrees. erys reaches the ear.

39 3./12.

Less headaches. Redness fades. 4th/12th fever free.

37.9 Less swelling. 8th/12th Sunlight.

10

0. W. 15 years (No. 7). 26./11. Erysipelas again. Recorded 11/27, Erys. already extends over the nose, cheeks, lips, eyes and part of the forehead.

Red room.

37.2

28./11. No progression. 29/11 fever free. The tumor

38.2 Significantly diminished throughout. 1st/12th Sunlight. Until 6./12. constant slight swelling of left cheek.

II.

Th. K. 52 years. Nurse in the deaf-mute asylum. Got facial rose on the 6th/10th Characteristic redness and swelling on nose and

39

Jaw.

40

7. 10. Red room with exclusion of sunlight as much as possible in a room with 4 windows.

Slow progression. Temp. unchanged high.

8th/10th - 10th/10th Same condition. Bad general order erys spreads over the hairy head.

11.10. Temp falls. 12. 10. free of fever.

12.AM 37 years. At the idiot asylum. 30.10. Erysipelatose redness and swelling on the right side of the face, originating from a nasal excoriation. 37.5o. dark room; the staff needs a red light when

it goes in

31.10. Below 37°. The redness disappears. Messages from Finsen's Medical Light Institute III.

9

blush continued. The right side catches on

2nd/11th Constantly no fever. scale up

13th JW

19 years.

At the idiot asylum.

In October against

ozaena treated.

14./11. erys the nose, cheeks and the left half of the upper lip. 37.80. Dark room (like No. 12).

Temp. stays below 37o. Redness stops spreading and disappears over the next three days.

3rd/12th Fresh erys. on the left side of the face and inside above the left eyelid.

dark room

4th/12th afebrile, but erys. has spread over a large part of the body.

6th/12th Constantly no fever. blush gone.

8th/12th Sunlight.

14. HM 51 years. Operated on April 19, 1900 due to recurrence of a penile carcinoma. There is still a fistula over the os pubis, which secretes easily.

2nd/2nd 1901. Redness and swelling of the right cheek and lower eyelid leave erys. assume. 3rd/2nd No fever, but the swelling has spread over the left cheek.

Red room.

Here complete freedom from fever. The swelling decreases immediately and is on the 6./2. completely gone. The patient is on 8.2. sent back to his department. The same evening: 38.5°. A plate-sized erysip. starting from a fistula and already on the left thigh.

Red room.

Immediate cessation of fever, erysipelas disappears.

Excerpt from the journals about the in the garrison hospital of Herr Corps physician Dr. Kier cases of rose treated in red light:

No. 1.

STEENBERG'S WIFE. In the hospital from 18./11.-28.11. 1893 for Erysipelas faciei and Nefritis acuta. The illness began 2 days before admission with chills, severe headache and nasal congestion. When recording on 18./11. Temp 40.2. Erysipelas around

left cheek, the eyelid, the nose and on part of the right cheek. Multiple bubbles.

epith. boric.

acetanilides

centigr. 25

40.3*)

19/11

erys now on the right as well as on the

40.2 left spread. no appetite Bad sleep because of headache.

Wine, milk, ice packs.

syrup. morphine. hydrochlor. teaspoon.

39.4

Erysip. has continued over the hairy parts and over

20./11.

40.4 the ear spreads.

Pulse 108, weak.

Red room.

Good sleep without narcotics. Is a little better.

40

The swelling and redness of the cheeks have diminished somewhat, but the affection has spread to the forehead and hairline. quite strong. apartment extremely low, drinks only wine and milk.

pulse 120,

22./11. 39.2 pulse 93, strong, felt less well yesterday,

3716 but now towards morning well. The rose hasn't spread since yesterday, the swelling and redness on the face have decreased significantly, so today the face is almost completely normal.

Sep Glacies.

She begins to feel like eating.

37.5 37

.

23./11.

Patient is generally well. She slept well during the night. No headache. The rose has not spread. Redness and infiltration also decreasing in the hairy parts. Remains of blisters all over the face. pp good

37 24./11.

constant subject. well-being A little more sensitivity

36.8 against pressure in the left temporal region.

Sep

Red room. Albuminuria was diagnosed in the following days, which is why the patient was transferred to another department. There was no recurrence.

under

*) Temp. above the line, temp. In the evening, the dashes of the running morning.

29/11

No. 2. ANDERSEN*), 23 years old Recorded on 28./11. because of Erysipelas in connection with Vulnus contus. capitis. Temp 40.5. Marked erysipelas-like redness and swelling of the left cheek and over the left side of the forehead, as well as over the hairy part of the head on the left side.

Red room. 40.4

Slept little at night. Is attacked quite badly.

40.7 P. 108, regular and strong. The rose has spread all over the forehead and down to the right cheek. urine normal.

Rp. I Siphon. 40.5 30th/11th subjective well-being Has during the night without Nar36.9

38.79 cotica slept well. Drinks his milk and wants more. No headaches, doesn't feel particularly dull. The rose has spread all over her face. edema of the eyelids. Copious formation of vesicles on the nose. pulse strong

Rp. 4 milk. Sep 1 siphon. 39.5 1st/12th The rose has got behind the right ear and further in

37.5 the nape region spread. Quite significant redness and swelling all over the face, especially on the right side. Gives subjective well-being.

Pulse 60. Crin normal. A large bulla on the nose has completely dried up.

39.0 2nd/12th Gives subjective well-being. on. The rose has turned up

39.5 the left parotid region and spread to the left ear. On the right side the process has lost itself. L'rin normal. 3rd/12th 40.8

Is quite well, he slept well after 38.2

syrup. chloral morfin.

I teaspoon. The rose is strong on the left side of the head, especially the left ear. Desires to eat more.

on.

38.5

4th/12th

well-being

Good sleep during the night after

36.5

Morfin juice, i teaspoon. The rose has gone everywhere except the left ear where there is still some tenderness and swelling. urine normal.

37.0 Still insignificant tenderness and swelling am

5th/12th

36.5

left ear. appetite and sleep well.

C'rin normal.

*) Unless otherwise indicated, the patient is male (Gemeiner). once vomiting. Redness and swelling have spread up to the forehead. Significant edema of all 4 palpebrae. Copious blistering on nose and chin. Pulse quite strong, regular. The crin contained traces of albums.

6.12.

36.5

Still a little swelling in the left ear.

36.7

7th, 12th

Swelling and redness now completely gone.

36.5 well being. apartment Well. Desquamation on the cheeks and ears.

Sep Milk.

8th/12th Scaling all over the face and head.

Sep Red room.

The following days natural conditions. Dismissed 12./12.

No. 3. CLIENT, 20 years old. Inserted on 19./12. The illness begins about 2 days before. 37.5. The nose is somewhat red, swollen and sensitive; the same is true of the adjacent parts of the cheeks.

Red room.

37.1 36.6

21.12. complete well-being The swelling and redness of the nose and the parts of the cheeks that touch it have completely disappeared. desquamation of the parts.

No. 4. KIRKEGAARDS, woman, 32 years. Recording: 14./12. 2 days ago chills and malaise, as well as redness of the nose. Temp. 410. Nose and cheeks show marked erysipelas-like redness and swelling. The affection extends past the ears on both sides and up to the eyes. There is no edema of the palpebrae. Distinct, sharp grizzly blisters on the right side of the nose and right cheek.

Rp. ice cream.

Red room.

Zen.

The patient slept a little during the night after the narcotic;

409

40 16./12. Some interrupted sleep during the night. the to

39.9 was essentially unchanged. The rose has spread somewhat to the hairy parts of the head; but the swelling and reddening of the face, as well as the edema of the eyelids, have greatly diminished. Some protein in the urine.

39.5

17th/12th To some extent felt like morfin juice during the night

39 sleeping.

The rose spreads over the neck and ears. On the other hand, it has disappeared from the face and all the blisters have dried up here. Feeling better overall.

desire to eat.

38.4 18th/12th Slept well throughout the night without narcotics.

37 feeling better today. The rose has not spread. Still swelling and redness on both ears and adjacent parts of the neck. hand. No particular sensitivity on hairy parts of head. Severely scaly face. appetite good. There are traces of protein in the urine.

Sep ice cream, milk and wine.

36.9

19./12.

Good sleep during the night. Taken as a whole

37 well-being The rose almost gone everywhere, just some tenderness on the back of the neck.

37 20./12.

The rose now gone everywhere. 36.8'

Sep

Red room.

The albuminuria persisted until discharge on 23/12.

No. 5. STEENBERG. Recorded on 12/18. Illness started 14/2 days before with severe chills. The patient is very depressed, sleepy and languid. Temp. 40. Considerable erysipelas-like redness of the nose and abutting parts of the cheeks.

Red room.

40.3 19th/12th Redness and swelling have become severe on the cheeks

40.3 and forehead spread. There is edema of all eyelids. blistering of the cheeks. Has slept through the night without use of sleeping pills and is soporous. Pulse regular but weak.

39.8

Sleep has been bad during the night. the

20.'12.

40

Rose has spread over the forehead and up to the ears; on the other hand, something has disappeared on the cheeks. General order, bad on the whole.

40.9 21st/12th Pulse 108, regular, strong. He claims he's better

40.1 to be found. Slept a little during the night after Morfinfaft. The rose has spread up to the hairy part of the head in a line corresponding to the coronal suture. Quite severe swelling on the stim and tenderness of the same. The affection has disappeared on the cheeks and nose. The bumps have dried up. desquamation on the face. moderate thirst. no appetite urine normal.

40.4 39.7

22.12. Pulse 96, regular. Slept well during the night after morfin juice. Overall better. The rose has spread up to the crown and temples, but has dwindled on the face.

40.1 23. 12. Bef seems to be a bit better. Today swelling and

39 Sensitivity of the whole neck region and right ear. The rose has disappeared from the face.

38.5

40.4 24/12 Was dizzy during the day yesterday. Wanted to be fired and out of bed. Slept well during the night without morfin juice. Feels quite well towards morning. The rose roughly unchanged. Begins to feel like eating.

40 25./12.

feeling better. Was clear yesterday. During the

37.5 night slept well. The rose has hardly spread but there is some swelling and tenderness on the left side of the neck and right ear. The process on the face has significantly disappeared, there is severe desquamation.

26./12. 40.3

The rose has returned today in the left face

40 half shown. Edema of the palpebrae of the left eye. sopor. Pulse 86, regular, quite strong.

39.8

Slept well during the night. The rose has

27/12

37.5 does not spread, but starts again on the left side of the nose.

39.1 28/12 Is quite well. The rose is back in now

37.5 Losing weight realized.

29./12.

3916

Be comfortable. Still redness, swelling and sensation

3776 possibility of the left ear. Very severe desquamation on the face.

37.2 30th/12th well-being Good sleep during the night. Only

36.8 rose of the left ear. Crin normal.

.

31./12.

40.6

Felt unwell last night. Chills. Pains

37.8 behind the left ear. Today the problem is better and the pain has subsided. Nothing objectively abnormal. The erysipelas process is standing. Severe desquamation.

Sep

Red room.

The following days well-being. Dismissed 4th/1st

No. 6.HANSEN, 22 years old. Inserted on 24./12. Illness started about two days ago. 37.6

There is erysipelatous redness of the nose and parts of the cheeks adjacent to it. No blisters. No clear border of the exanthem.

Red room.

38.5 25/12

The rose has spread to the left ear. There are

39 now clearly wall-like borders present above the temporal region.

40 26.12. The subjective condition is good. slept well appetite

39.2 good. The rose has spread over the right side of the face and over the hairline. urine normal.

The rose has spread a little over the left ear

The rose is strongly pronounced on the left ear today.

37

37.7

29.12.

Still redness and swelling of the left ear. strong em

37.5 tenderness and swelling of the glands behind the left ear. subjective well-being

Rp.

37.5

ver

epitheme, tepid. 30. 12. The mentioned sensitivity of the glands has

37 pulled. Still redness and swelling of the left ear.

36.7

31./12.

perfect well-being Just a little red on the left

36.6

ear flap.

Sep

Red room.

Continued well-being the following day. dismissed 6./1.

No. 7. KIRKEGAARD'S WIFE, aged 32 (compare No. 4). Recording 26./12. Became ill again immediately after being discharged from the previous hospital stay. 39.9. There is some redness and swelling of the nose and adjacent parts of the cheeks. Some edema of the lower lids of both eyes. A few isolated bumps on the nose.

red room,

39.7

27/12

37.9

28/12

3716

Quite a good sleep during the night. Command, as a whole

37 better. The rose has not spread. urine normal.

37.6 30th/12th

well-being The rose has lost itself a bit in the face,

37 still some tenderness and swelling in front of and behind the ears. L'rin normal.

31./12.

37 37"

wellbeing.

dismissed 9./1.

As you can see, it is not possible to draw reasonable conclusions from these 7 medical reports. In cases no. 1, 2 and 3, where one could assume a favorable effect of the treatment, it is possible that the course would have been just as favorable without treatment. On the other hand, the cases where the fever persisted and the disease spread despite treatment are also not decisive evidence against the value of therapy; because without this treatment the course might have been even worse. The capriciousness of this disease makes it impossible to draw any conclusion from it. Because dr Krukenberg's good results are available, but there is every reason to continue with the experiments, which would best be carried out very systematically in a larger hospital together with control experiments. In any case, this treatment has the advantage over so many others that it can be used without hesitation because it is harmless.

literature review.

PAUL DARBOIS: TRAITEMENT DU LUPUS VULGAIRE SUIVANT LES INDICATIONS. Paris 1900.

The author discusses the technique and results of a number of different treatments for lupus vulgaris, about 30 in all. Of these, in his opinion, the following are capable of curing the disease: scarification, ignipuncture, galvanocaustic scarification (scarification ignée), the surgical methods (Excision, scraping), Caustica FINSENS method.

Of the more recent methods of treatment, the author considers the following to be incapable of curing the disease: Koch's tuberculin TR, streptococtoxin, various serums, Holländer's hot-air method, calomel injection, d'Arsonval's streams (courants de haute fréquence et de haute intensité), electrolysis, X-rays.

It is interesting that d'Arsonval's currents, which gave good results against lupus erythematosus, had no ameliorating effect on lupus vulgaris,

An ideal treatment, says the author, must be one that is easy to use, painless, and provides rapid, definitive healing and beautiful scars. Regarding these individual points, he notes that 1) none of the other methods produce scars as beautiful as the Scarification and FINSENS methods; 2) definitive healing is possible with all of the methods mentioned, well understood,

the patient can be kept under observation for at least 2 years in order to be able to treat any recurrences and residual lupus foci. So the author does not consider it an objection to the FINSENS method that the patients have to undergo one or more short follow-up treatments in the first few years after the completion of the main treatment; 3) the fastest treatment is undoubtedly excision, provided that prima intentio is achieved. The author therefore recommends this treatment in cases where the condition is operable and located in a place where the scars appear

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is of secondary importance. As far as speed is concerned, the FINSENS method comes second. All other methods, including scarification, take longer to heal than the FINSENS method; 4) The author rightly counts the painlessness of the treatment as one of the most important points. None of the other methods can be compared to Finsen's in this respect, which causes no or almost no pain.

From the above one can see that the author considers the FINSENS method to be the most perfect. In his "Conclusions" he expressed this view in the following way: "Finsen's method is indicated in the majority of cases. However, lupus of the mucous membrane cannot be treated by this method. Besides, it cannot be applied to country people and poor people who do not come to the hospital."

" With these caveats, it can be said that because of the relative speed of action and the excellent scars it leaves, FINSENS method is the best of all the treatments used in lupus therapy."

This acknowledgment of the superiority of FINSEN's method gains additional significance because the author expressly states in his introduction, "It is Dr. Brocq, who first gave me the idea for this work, and it is he who partly inspired the conclusions."

VALDEMAR BIE.

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from

LEREDDE: LA PHOTOTHÉRAPIE ET SES APPLICATIONS A LA THÉRAPEUTIQUE DES AFFECTIONS CUTANÉES. Bulletin general de therapy. 70e année, t. 141 P. 129.

LEREDDE: LA CURE PHOTOTHÉRAPIQUE LUPUS ÉRYTHÉMATEUX. Bulletin of the society of therapy. 36th year, 4th series, t. VI, no. 1, p. 21

The author gives a detailed report on FINSENS "La Photothérapie" and also publishes his own experiences on treatment with concentrated light according to the FINSENS method.

Regarding the results of the treatment of lupus vulgaris, the author is of the same opinion as Darbois: FINSENS method is the least painful and gives the largest percentage of cases healed, the surest definitive healing, and the most beautiful scars. He, too, makes only one objection: The costliness of the treatment will prevent the poor patients who cannot come to the hospice from availing themselves of it, But he supposes that the director of public charity will see that it is cheaper for to care for the healing of such patients than to get them into poor care sooner or later.

LEREDDE treated a patient with acne rosacea nasi. Significant improvement has been achieved, but so slowly that if this is the norm, LEREDDE can only recommend light therapy in the few cases of this disease that are refractory to usual treatments.

On the other hand, he has been very satisfied with the results of light therapy in a severe case of rhinophyma; the lowest part of the nose was twice the normal size, and transformed into a blood-filled sponge. In 30 séances of 1/2-1 hour duration he achieved a significant reduction in nose size and the color became bright red.

Furthermore, the author treated 2 cases of sycosis several years old, which had defied every treatment. In one case a very clear improvement was achieved after 12 séances.

In "la Société de thérapeutique" LEREDDE has published his experiences on the treatment of lupus erythematosus with concentrated light, according to the FINSENS method. He has treated 11 cases, almost all of which have previously been treated with great persistence, but without any result with almost all known The author is particularly interested in the fact that one of the patients who had previously been treated with D'ARSONVAL's currents in 70 séances without any result was, in his and BROCQ's opinion, one of the best treatment methods for lupus erythematosus in 22 séances of light treatment got significantly better.

In 2 of the vi treated patients only slight flattening, reduction of congestion and atrophy of the epidermis on the treated sites was achieved. The author remarks that the treatment has been too brief (10-12 séances) to admit of any definitive judgment.

In 3 severe cases the author has achieved partial healing and for the rest of the ailment significant improvement.

Finally, complete healing is achieved in 3 cases with resp. 35, 7 and 45 séances, and 3 other patients whose treatment is still ongoing, have improved so much after 40, 22 and 30 séances that LEREDDE is allowed to predict a complete cure. All in all, LEREDDE believes that FINSENS' method is "the best method for treating the severe forms of lupus erythematosus".

VALDEMAR BIE.

MALCOLM MORRIS AND S. ERNEST DORE: REMARKS ON FINSENS LIGHT TREATMENT OF LUPUS AND RODENT ULCER. British Medical Journal no. 2093, Feb. 9, 1901, p. 326.

In this article, among other things, there are some valuable remarks on the technique of treatment, skin reaction, favorable and unfavorable conditions for the treatment, etc

In all the cases of lupus vulgaris treated by the author there has been marked and regular improvement, though in some cases very slowly.

Significant improvement has also been shown in lupus erythematosus, although not as reliably as in lupus vulgaris. A medical report is quoted, which definitely indicates that in the treatment of this disease it is important to produce as severe a skin inflammation as possible.

The authors' comments on Ulcus rodens are interesting. They suggest that the light has a significant stimulating effect on the tissues at the bottom and margins of the ulcerations, both in lupus vulgaris and in l'lcus rodens, so that rapid ingrowth of the epithelium from the surrounding area occurs soon after treatment. In some cases where the epithelium was not ulcerated, the tumor after treatment became red, slightly excoriated and softened, and gradually disappeared without loss of substance.

VALDEMAR BIE.

STEPHEN MACKENZIE: ON PHOTOTHERAPY OR THE LIGHT TREATMENT ON LUPUS VULGARIS. The British Journal of Dermatology Vol. 11, No. 133

LORTET ET GENOUD (FACULTÉ DE MEDICINE DE LYON. LA BORATOIRE DE PARASITOLOGY): LA LUMIÈRE AGENT DE THÉRAPEUTIQUE. lyon 1900,

THEODOR SCHÜLER: ABOUT LIGHT TREATMENT WITH SPECIAL REFERENCE TO PROFESSOR FINSEN'S TREATMENT WITH CONCENTRATED CHEMICAL RAYS OF LIGHT. Monthly journal for orthopedic surgery and physical healing methods. Vol. I, No. 3, 1901.

HENRY W. STELWAGON: PHOTOTHERAPY IN CUTANEOUS MEDICINE. The University Medical Magazine, Dec. 1900

These 4 papers contain reports about the author's visit to Finsen's Light Institute.

VALDEMAR BIE.

MAGNUS MÖLLER (Stockholm): The influence of light on the skin in a healthy and diseased state.

Bibliotheca medica. Dept. D. II, Dermatology and Syphilidology, ed. v. Prof. NEISSER. E. NAILS. Stuttgart 1900. 142 pages.

In this book, which is furnished with beautiful photographs and biological tables, the author gives a comprehensive description of the investigations of recent years into the effects of light and X-rays on the skin. Partly the effect of sunlight and electric light on healthy skin is treated with great thoroughness, partly the importance of light for "summer prurigo", hydroa estivalis, xeroderma pigmentosum and sexual diseases, as well as the effect of light on pellagra and FINSEN's smallpox treatment,

The author also describes some of the illumination experiments he himself carried out with the associated histological investigations of great interest. He used the same lighting apparatus with which WIDMARK made the fundamental experiments on the skin-irritating ability of ultraviolet rays, namely a water-filled metal cylinder, one end of which was closed with a rock-crystal lens and 13 cm focal length, the other end with a flat glass plate with a cutout , in which a flat plate of rock crystal was cemented. The rays of an electric arc lamp of 1200-4000 normal candles were collimated by means of the rock-crystal lens mentioned and then passed through the water layer and the glass and rock-crystal plate, behind which the author illuminated his own skin or that of the experimental animal. His experiments led to very similar results as WIDMARKS and FINSENS. With the use of suitable intensity of light and suitable time of illumination, erythema of light appeared only on the parts of the skin corresponding to the rock-crystal plate, while those of the rays which had passed through glass showed no such effect, from which the author concludes that the effect is due to the ultraviolet rays is, even if, as he himself points out, one must not conclude from this that the visible rays cannot also have a similar effect on the skin when the light intensity is greater. As an effect of the ultraviolet rays, the author observed, in addition to the well-known vasodilatation, a reduced transparency of the epidermis as a result of proliferative processes. This "clouding" of the epidermis appeared 2-3 days after the illumination; it increases in the same proportion as the photochemical action decreases, and persists until the desquamation ceases. It was particularly evident when the treated area of skin, e.g. B. a rabbit ear, was illuminated in transmitted light. Histologically, this reduced transparency is due to "a parenchymal edema, an abnormally increased sap content of the epithelium with attendant hyperplasia", which is particularly evident for the horny layer, which becomes more than twice as thick as in the normal state and shows an abnormal keratinization process , in that the nuclei of the horny cells are preserved and are abnormally affected by the dyes. According to the author, this process caused by ultraviolet rays serves to protect the underlying layer, similar to vascular dilatation and pigmentation that occurs later.

The author investigated the deeper effects of light, especially on the ears of white rabbits, by collecting the light on the inside of the ear with the help of Widmark's apparatus. With the right intensity of light, he achieved not only an inflammation limited to the part of the rock crystal with blistering on the inside of the ear, but also a corresponding, though less severe, affection on the outer side. The author takes this as proof of "the not insignificant depth effect of the ultraviolet rays". As to what else we know of the low ability of ultraviolet rays to act in depth, it is perhaps doubtful whether the author is right in this assumption; it is perhaps more of a collateral flux of significant intensity. The histological examination of the vasodilatation showed, among other things, a strong dilatation of the smaller arteries; while their lumen generally shows on section a more or less contracted muscularis, with much-outlined elastica, the exposed arteries, on the other hand, showed a thin, unfolded muscularis and an almost smooth elastica, so that they resembled veins rather than arteries. When the strongest illumination was used, thrombus formation occurred in the skin vessels.

A series of experiments on guinea pigs and rabbits, with a view to investigating whether "sunstroke" could be induced by exposing the heads of these animals to strong ultraviolet light, gave negative results, nervous phenomena appearing only in those cases in which the heat rays were not carefully excluded.

SOPHUS BANG.

to

SÖREN HANSEN: About the sunlight in Copenhagen. Some remarks regarding the revision of the building law.

Tidsscript for Sundhetspleje. i R. VII. pp. 65–78.

In this essay the author wants to draw attention to the fact that the building law should take into account the lighting conditions of the streets and dwellings to a much greater degree than has been done up to now. Certainly, the building regulations gradually show a progressive tendency, in that they previously dealt exclusively with the risk of fire, nowadays they aim more towards hygienic conditions. But sufficient consideration of the hygienic importance of light seems to be lacking. Copenhagen is what sunshine is. reached, quite neglected by nature. Of the 4400 theoretically possible sunshine hours of the year, the sun only shows itself 1200, while e.g. B. Berlin 1727 has. Of the larger cities, only London (with 1026 hours) seems to lag behind us. To this must be added the poor quality of much of the sunshine that is granted to us. One would think that in these circumstances there would be a demand for the buildings to be so constructed as to rob one another of as little sun as possible; but the author's calculations show that our building law, instead of taking advantage of these circumstances, places us, on the contrary, more disadvantageously disadvantaged, as far as sunshine of the facades are concerned, than the cities with which we are almost to be compared, such as; B. Berlin. With us, the height of the house may be 5's of the street width, yes, in some cases even more. pass; in Berlin, the height of the houses must not exceed the width of the street. This is to say that in a street running east-west with houses 27 cubits high, the northern row of houses in Berlin will have a sunlit area 6 cubits more in a vertical position than the corresponding one during the midday of the equinox Row of houses in Copenhagen. In order to achieve Berlin's lighting conditions, the southern row of houses in Copenhagen would only have to be 8', the street width, instead of the now prescribed 5/4. In the interior of the city, of course, such demands cannot be carried out, but it would be possible for the suburban areas, for which the author even proposes the normal ratio 23, which would mean that the southern row of houses at midday on the equinox is not part of the could shade the northern row of houses. It is hoped that the ever-growing desire for light as a comfort, and the growing understanding of the hygienic importance of light, will cause the author's commendable proposal to be considered by the authorities.

SOPHUS BANG.

Feb 1902.

Hugh WALSHAM: On the ultra-violet light from a rapid oscillation high-tension arc, for the treatment of skin diseases. The lancet.

Ultraviolet rays, with a wavelength of about 200 millimeters, make the air they penetrate conductive to electricity. The author used this property to investigate the penetrating power of these rays. He used an AC lamp, which is not described in detail, as his light source. When the light of this lamp was directed towards an electroscope charged with negative electricity, its gold leaves collapsed, and the speed with which this process took place the author used as a measure of the quantity of the rays mentioned. By inserting various bodies between the lamp and the electroscope, he determined their absorption ratio. According to his experiments, two 2 mm thick quartz plates at a mutual distance of 10 mm absorb 60% of the rays that affect the electroscope. If the space between the plates is filled with water (distilled? boiled?), 10-15% of the remaining rays are absorbed. A gelatin plate 0.04 mm thick blocked all rays, while a 6 inch thick block of ice absorbed little more than the corresponding column of air.

This relationship led the author to use small, inch-thick pieces of ice as compressors instead of Finsen's pressure glass in the light treatment of lupus. The author assumes that the cold effect of the ice will also contribute to the completion of the local ischemia.

That the author was able to use this technique at all can only be explained by the fact that he used a weak light source for the treatment of lupus without concentrating the rays, and that the sessions only spread over

Messages from Finsen's Medical Light Institute III.

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10-15 min, extended. Experiments at Finsen's Light Institute have shown the sufficiency of such a method - and in addition, rays with such great refractivity are absorbed in the uppermost layer of the skin.

The author concedes this, emphasizing that the penetrating power of light rays decreases with their wavelength, but he tries to circumvent the matter in a few words, saying that "the wavelength is so easily lengthened or shortened if the rays also hit different bodies, that it would not be wise to dogmatize on that point!"

It is clear that such an application of ice as a means of compression must also be very uncomfortable for the patients; the author also does not mention this downside of the matter.

GUNNI BUSCK.

GJ MÜLLER: Actinotherapy. Medical calendar of the general med. Central newspaper. 1902. Berlin.

Under the name "actinotherapy" the author summarizes the four modern physical treatment methods below, of which he gives a clear and concise description. Application of 1) The Concentrated Chemical Rays of the Arc Lamp During an epidemic which broke out in Egypt in the spring of 1900, a total of 177 smallpox patients were admitted to the Infectious Disease Hospital in Cairo. Of these, 25 were treated according to Fiosen's method.

or sunlight according to Prof. Finsen's method, 2) X-rays, 3) the ultraviolet rays of the induction spark

Strebel's method,

4) Becquerel rays. In his review of the conc. chemical The author agrees in all essentials with the views put forward by Prof. Finsen and his students, only theoretically he places greater value on the inflammatory properties of the rays than on their bactericidal power.

The author recommends X-rays especially for the treatment of hypertrichosis, sycosis parasitaria, and favus. He finds it contraindicated in all acute, inflammatory dermatoses.

Strebel's apparatus for utilizing the ultraviolet rays of the induction spark and Becquerel rays (pseudo-acting rays emitted by L'ran and Thor) are just mentioned by the author.

GUNNI BUSCK.

dr ENGEL (Cairo): On the treatment of smallpox with red light, together with some remarks on forced vaccination.

" Therapy of the Present", March 1901.

As a result of a well-carried out mass vaccination (in April alone over 278,000 inhabitants of Cairo were vaccinated or revaccinated) the epidemic came to an end shortly after the treatment had been set in motion.

The author publishes his results in the above-mentioned essay, expressing the hope of contributing to the "becoming known" of a method that has not yet received the attention and dissemination that the author believes it deserves.

The author describes the tremendous change that took place in the sickrooms after the chemical rays had been excluded: the penetrating stench, which was almost unbearable due to the accumulation of so many suppurating patients, disappeared completely and with it the numerous flies, which used to be an incessant plague had been for the patients.

The author was not able to observe any harmful effect of staying in the filtered light on the patients or the staff, but he emphasizes that the patients became restless and it was difficult to keep them there until the vesicles had completely dried, precisely because of this early subjective well-being.

Although the skin lesions always assumed an abortive, benign character without suppuration, the author found that the treatment had no effect on the exanthema localized on the mucous membranes (pharynx, larynx, conjunctiva), and he believes this to be the cause of the contradictory results of the different observers regarding the relation of suppuration fever under Finsen treatment. It emerges from the patient reports that have been given that the affection of the mucous membranes taken as a whole is of great prognostic importance, something to which earlier authors (e.g. Curschmann) have already drawn attention. If the author writes, refraining from the foudroyant cases of purpura variolosa and variola haemorrhagica, as well as the cases in which the mucous membranes are primarily severely attacked, the disease will proceed like a variolois, and the cosmetic result will be satisfactory

from the moment the patient is treated according to Finsen's method.

The author calls these: the first rational and methodical treatment of the variola; he thinks that it should be introduced everywhere as an obligatory part of the treatment of small-pox, and that permanent installations for such treatment should be erected in all those States where cases of small-pox are constant—or only frequent.

As can be seen, the author unconditionally and zealously follows the followers of the method. All the more strange appears his view on

has been!

the impact of treatment on mortality. For the author does not believe that it will bring about any reduction in the mortality rate, although he concedes that it may have some influence by preventing mixed infection and complications in the later stages of the disease, which is of particular importance to the old and weak patients may have.

One should certainly be careful with numbers; but one can also be so cautious that the conclusions are misinterpreted. When going through the author's statistics, it is also evident that he is very cautious

The smallpox patients, few of whom were vaccinated and none revaccinated, were interned in 2 pavilions A and B. The milder cases were placed on A, the heavier on B, and this separation between mild and severe cases continued in the same way after Finsen treatment was introduced in Pav. B on May 8th. Mortality rate before May 8 in Pav. A was 17 o0 (6 of 35). In Pav. B: 45% (9 out of 20). After May 8th in Pav. A: 20% (1 in 5) died.

In Pav. B also 20% (5 out of 25). Of these 5 patients who died despite the treatment in red light, one was a child who was not brought in until the suppuration stage and thus received treatment too late, since it is precisely the importance of the method that the suppuration prevented. The 4 others had what the author just emphasizes, in addition to a confluent skin eruption, an intensive and severe affection of the mucous membranes in the fauces and in the lust tubes.

The author draws his conclusions from these figures!

In various monographs on variola, Referent has sought statistical information on the days of illness on which deaths most frequently occur. It goes without saying that Finsen treatment, which is only aimed at preventing suppuration, cannot influence mortality in the first 9 days of illness.

On the other hand, it is also clear that the mortality due to cutaneous suppuration and its related complications is reduced to 0 in view of preventing the suppuration.

Most authors state that purpura variolosa almost always causes death in the first few days of the disease.

Leaving aside these foudroyant cases, the greatest mortality occurs during or after the period of suppuration.

from

Now, since the author considers it clinically established that by shutting out the inflammatory rays of light from the patients, one must protect them from cutaneous suppuration and its consequences

also logically conclude that such treatment reduces the mortality rate for variola.

Finally, the author mentions forced vaccination. He believes in the possibility of their beneficial influence on the secondary period,

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and thinks that it can hardly pose any danger to the patient and should therefore be tried wherever Finsen's method cannot be carried out.

GUNNI BUSCK.

DEGRAIS: Des rayons chimiques et de leur emploi dans la therapie des Affections cutanées. (Traitement du Lupus par l'appareil Finsen.)

Thesis. Paris. 1901

The author has thoroughly acquainted himself with the literature on chemical light rays that has appeared in recent years. Magnus Moller and Finsen seem to be his main sources. Without getting involved in any criticism, he guides the reader through the entire physiology of light in just a few pages: the influence of light on metabolism, light erythema, pigmentation, incitement and permeability.

After the general part comes a description of phototherapy. Finsen's apparatus for concentrating sun and electric light is described in detail. He also describes Lortet et Genouds and Faveau de Courmelles et Trouvés apparatuses, as well as an acetylene lamp specified by Callevilles. The author speaks with great caution about the latter. So far we only know the value of the fins installation, and the results presented by the author are all due to them as found in the Saint Louis Hospital (Dr. Balzers Service). He has a total of 16 case reports: 13 lupus vulgaris partly cured, partly improving. In 3 cases the treatment with fins was combined with scarification (Leredde's suggestion), and the author expresses his satisfaction with it. Scarab cations were performed under cocaine anesthesia immediately prior to light treatment. The remaining 3 were Lup. erythematous They proved refractory.

Finally, the advantages and disadvantages of fissure treatment are compared and the indications for the same are established, all in substantial accordance with Dubois' dissertation (which is referenced in this volume).

HANS JANSEN.

BAYLE: Contribution to the study of phototherapy. (Method de Finsen.)

Thesis. Lyons. 1901

This dissertation is supervised by Prof. Lortet and Dr. Genoud's Aegis appeared and therefore concludes with the thesis that her lamp can replace Finsen's. The work as a whole is extremely thorough. It is divided into three sections. The first gives an overview of what was known of the effects of light before Finsen, and particularly emphasizes the French contribution; the second is devoted exclusively to Finsen's work, and the third deals with Lortet and Genoud's lamp.

With regard to the last section, I can refer to Lortet and Genoud's original papers, since there is nothing particularly new in Bayle.

HANS JANSEN.

FOVEAU DE COURMELLES: La Finsentherapy.

Le Medicin.

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against 1901.

FOVEAU DE COURMELLES: La Phototherapy. Le Progres medical. November 2, 1901.

The articles mentioned are two of the many that the author published in the last six months. In all of these, the author moves in the most peculiar way between lyrical outbursts of mood and strict scientific nature, and reports in bulk what has appeared in the field of light therapy, without making any distinction. The final refrain is always that the only excellent thing is an apparatus of his own construction, which, while described and illustrated, is so obscurely that it has been impossible for the reviewer to get any clear idea. The light source can be either "an incandescent lamp with a peculiar charcoal (lampe à incandescense à charbon spécial), the composition of which has not yet been published", partly an ordinary arc lamp. In both cases only 5-8 amps are necessary; Finally, the use of an acetylene lamp is also possible. This light source is now placed in a metal shell, the back of which is a parabolic mirror and the front of which is a screen with a quartz pane. Everywhere the housing consists of double walls through which water flows. The light source is placed in the focus of the mirror, which means that all light is emitted in front as parallel rays. There seems to be no concentration. Only the rays that hit the disc reach the patient. Closer criticism of a lamp so poorly defined is impossible; it is only to be emphasized that a mirror application was tried here long ago, but abandoned again, as they are attacked and ruined very quickly, at least when using an arc lamp.

HANS JANSEN.

LORTET & GENOUD: Appareil phototherapeutic sans condenser. Compt. ren. des séances de l'Acad. des Sciences t. CXXXII p. 527 (4 Mars 1901).

LORTET & GENOUD: Appareil phototherapeutique sans condenser pour l'application de la method de Finsen.

Lyon Medical (17 Mars 1901).

Notice sur l'appareil phototherapy de Lortet & Genoud.

Prof. Lortet, dean of the medical faculty in Lyon, who was one of the first to introduce Finsens phototherapy in France, did not limit himself to this. In association with Dr. Genoud he attempted to find an improved arrangement for the therapeutic use of the arc light, and it is this "lamp" that is available to the public in these treatises. Though scarcely as excellent as the authors seem to suppose, there is much good in their endeavors, and as the lamp was widely used in France it has done much to prepare the way for phototherapy.

Lortet and Genoud set themselves the goal of 1) avoiding the concentrator because it absorbs part of the light, and 2) making the lamp available for individual treatment so that every general practitioner can have it in his room. You therefore need an electric projection lamp (an ordinary arc lamp with charcoal arranged at an angle), which emits the light essentially to one side, and bring the diseased part at a short distance from the arc. They can do this by inserting a metal screen with double walls, through which cold water flows, between the patient and the light source. This metal screen has a circular opening of 2.5 cm just in front of the arch, which is closed with a Finsen pressure glass through which water flows. If the patient is pressed firmly against this, any heat effect should be excluded. The lamp has to be regulated by hand and can be adjusted in all imaginable ways by means of numerous screws. It should burn at 12-15 amps, 55-65 volts, the arc should be at a distance of 2-4 cm from the pressure glass, and the duration of the séances should be only 10-15 minutes (in the earlier treatises 8 -10 amps, 1-2 cm distance and 15-20 min).

Quite apart from the fact that it is impractical to mount the patient in this way and regulate the lamp by hand, it is not a priori likely that this lamp can do the same as the fin installation. It is quite certainly impossible to investigate the relationship between these two apparatuses by way of calculation; because on the one hand it is not easy to decide how much Lortet gains through the projection position, and on the other hand it is not easy to calculate how much Finsen loses through the concentration apparatus. We can only point out the following: 1) Lortet does not take full advantage of the projection position. In this case, the crater will lie somewhat on the side of the carbon, but will not be able to be absolutely vertical and the rays will therefore not fall horizontally to the side either, but will fall a large part outside and below and in this way will hit the pressure glass at an unfavorable angle or not at all . 2) The patient is absolutely not so mean near the light source. Because apart from the 2-4 cm that lie between the sheet and the printing glass, this represents another 2

cm that the treatment distance becomes 4-6 cm. At Finsen's treatment distance

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one must calculate the distance from the arc to the front lens of the concentrating apparatus; here the rays are made parallel and they retain their intensity in the further course. This distance is 12 cm for an ordinary 7 cm apparatus. So Lortet takes the light from a place where it is 4-9 times stronger than where Finsen takes it from. But whether this slight advantage in connection with the projection position of Finsen's concentration, with which the light is increased approx. 30 times according to calculation, should be able to outweigh its 5 times higher power consumption and finally its 4-5 times longer treatment time, is still little probably.

The question can be solved by exact comparative experiments; Lortet & Genoud does not cite a single one of these.

They conclude exclusively from "les effets réactionnels et curatifs". Exanthema and blistering occur just as in the case of fins treatment; but the authors are perhaps not aware that the Finsen apparatus can achieve quite the same thing in a still shorter time. The maximum reaction is reached quite quickly, often after just a few minutes, and increasing the lighting time or the light intensity does not significantly change their appearance, although it is likely that the greater the depth effect

becomes. Finsen was therefore rightly never satisfied with the time and light intensity that was necessary for the maximum effect, but went much further and was therefore able to achieve a greater depth effect.

It should now only be added that at the local light institute we made a series of tests with Lortet lamps, which will be published later, and the main result of which is that this lamp is 3-4 times weaker than a fins installation in terms of bactericidal activity and depth effect a 70 amp arc lamp and a 7 cm concentrator and so represents a significant step backwards.

HANS JANSEN.

STREBEL: A LIGHT THERAPY QUESTION. Viennese clinic Rundschau No. 50-51, 1900.

STREBEL: A CONTRIBUTION TO THE QUESTION OF LIGHT THERAPY IN. INSTRUMENTARY. Relationship of the German dermatol. Company. Breslau 1901.

STREBEL: THE USEFULNESS OF INDUCTION SPARK LIGHT IN THERAPY. Lecture. The 73rd Assembly of German Natural Scientists and Physicians. Hamburg 1901.

dr Strebel in Munich has been busy with phototherapy in recent years, especially with its physical side, and shows significant expertise in this field, and on average a lot of criticism, even if, as the speaker thinks, he is inclined not to be entirely justified to set up hypotheses.

let's go

In the first essay the author rightly rejects the light boxes that are so widespread, whether they are equipped with arc lamps or incandescent lamps. They do little in terms of photochemistry, and noxious gases are collected in them. Instead, he suggests letting the patient lie in high-intensity projection arc lamps with specular reflectors. He sees the purpose of inserting colored glass plates

While the author here attacks at all the strong charlatanism practiced with the use of different lights, he touches on the treatment of smallpox and here shows a curious lack of understanding, saying that he cannot see why it is red light should be; Darkness should have the same purpose.

In the second, the author deals with the important and modern question of the value of ultraviolet rays. He points to their significant absorption through a series of trials; he thus finds that a 1 mm. horn plate absorbs most of it, as does glass. Perhaps they could penetrate better in a concentrated form. He tests this by, by means of a quartz lens collecting ultraviolet rays differentiated by a prism, pointing the cone of light against a stick of skin and holding a fluorescent screen behind it; while no fluorescence after penetrating through a together

In contrast, visible fluorescence appeared after passage through freshly excised human skin. Apart from this experiment, which one would have liked to have repeated and varied, he concludes that the external ultraviolet rays are of little value where it is necessary to penetrate the skin. Finally, the author suggests replacing lens concentration with mirrors. A new mirror metal, Magnalia, has been invented, which is said to be more resistant to the ozone effect of arc light. Using a few drawings, he shows how he envisages the installation in such a case. In the same lecture, but without connecting to the rest, the author presents his "spark light" on the main theme

the third paper. The principle of this STREBEL lamp is to allow strong induction sparks to flash between electrodes made of aluminium, calcium or zinc. This produces a very strong, only slightly luminous light in ultraviolet rays. It is almost quite cold, so that it can be inserted into the body cavities, and here the author also wants to look for an area for "ultraviolet therapy", believing that the mucous membranes are more penetrable than the skin. Finally he places some therapeutic results obtained with this light, including 2 cases of gon.fluor.albus and 2 cases of urethritis in men.

HANS JANSEN.

from

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Lupus vulgaris pharyngeal.

A clinical investigation').

Of

Holger Mygind.

I&quot;n undertook the period from July 1898 to February 1899

I conducted an examination of the external nose, nasal cavity, nasopharynx, pharynx, palate, larynx and trachea in 200 patients treated for lupus of the external skin at FINSENS Medical Light Institute in Copenhagen. After the results of the examination of the larynx of these patients have been published, it has been my task in the present work to report on the examination of the pharynx of the patients mentioned; this is naturally followed by a brief description of the lupus affections found on the anterior surface of the soft palate and on the hard palate, as to whether or not they were associated with pharyngeal lupus changes.

As mentioned in my earlier work, among the 200 patients with epidermal lupus studied, 57 were males and 143 were females, and their age distribution was as follows:

1) Is also published in the Archiv für Laryngologie, Vol. XIII, Issue 3.

2) Archives of Laryngology, Vol. X, p. 131. Communications from Finsen's Medical Light Institute. IV

1

Overview of 200 examined patients with lupus der

outer skin, distributed by sex and age.

Of these 200 lupus patients, 36 (13 males and 23 females) had lupus nodules or ulcers or scars in the pharyngeal cavity or on the isthmus faucium. Thus, pharyngeal lupus or scars after it were found in 18% of the patients examined).

Since, as can be seen from the overview, many of the patients admitted to it suffered from lupous changes in the hard palate, it will be of interest to add to the overview the remark that four women (respectively 16½, 21, 21 and 44 years old) and four males (16, 20, 22, and 44 years old, respectively) had lupus or scars on the hard palate without concomitant lupus affection of the pharynx. Lupus changes localized to the soft palate alone did not occur in any case.

1) It should be noted that in 5 out of 200 patients a thorough examination of the pharynx and especially the rhinopharynx could not take place because of scar-like narrowing of the mouth opening; among these 5 patients were no. 13, 26 and 35 of the overview below.

Unfortunately, it is not possible to compare the results obtained from the objective examination of the 200 lupus patients with regard to the frequency of occurrence of lupus in the pharynx with the results of other statistical examinations of a similar character; for in the few works which concern this question, the results have been communicated in so little detail that it does not appear from them how frequently pharyngeal lupus proper occurred in the various investigations. CHIARI and RIEHL) state that out of 68 lupus patients examined, 24 suffered from lupus of the mouth, throat or nose. HOMELLE 2) states that lupus faciei is complicated in just over one fifth of cases with lupus of the buccopharyngeal mucosa”. Nick HOLM) found 19 of 124 lupus patients at the Municipal Hospital in Copenhagen in whom lupus of the mouth and throat could be detected. In BENDERS) work involving 380 lupus patients, the description of the lupus pharyngeal affections is very cursory: in 17% of the cases, lupus affections of the mouth and pharynx were found. LELOIR) finally states that he under Overview of 36 individuals with lupus pharyngis?).

1) Lupus vulgaris laryngeal. quarterly f. dermat. and Syphilis, 1882, p. 663.

2) Des scrofulides graves de la muqueuse bucco-pharyngienne. Paris 1875, p. 99

3) Klinisk Fremstilling af Lupusaffektionens Forhold til Scrochulose etc. Copenhagen 1878, p. 17

4) Veber lupus of the mucous membranes. quarterly f. dermat. & Syphilis, 1888, p. 891. 5) Traité pratique etc. de la scrofulo-tuberculosis etc. Paris 1892, p. 162

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1) Abbreviations: N. = scars after lupus; atrophy = atrophy d. pharyngeal tonsil and mucosa; cat catarrh ; Kn. = lupus nodules.

312 lupus patients 57, uh 18% of all cases, with lupus of the bucco-pharyngeal mucosa was found. The last two numbers appear to deviate only slightly from the percentage established by the present study, because - as can be seen from the above - among the 200 lupus patients in the FINSENS Light Institute there were a total of 44 who suffered from lupus of the pharynx and the hard palate; however, it must be strongly emphasized that the present study did not include gingival lupus, while the studies mentioned probably included it.

There is therefore much to suggest that the percentage found here as an expression of the occurrence of pharyngeal lupus in patients with lupus of the outer skin is somewhat higher than that found in other investigations. This relationship was probably caused by the fact that the investigations on which the present work is based were carried out more thoroughly than those, namely insofar as, among other things, the rhino-pharynx was examined in all cases; however, five cases (including Nos. 13, 26, and 35 of the review) are an exception in this regard, in which large lupus ulcers and scars at the mouth opening prevented both posterior rhinoscopia and digital exploration of the nasopharynx.

When it comes to illuminating the etiology of the paryngeal lupus affection, it is above all necessary to examine its occurrence within the different age groups and both sexes. How this ratio turned out in relation to our 36 patients can be seen from the following overview.

Overview of 36 patients with pharyngeal lupus distributed

by age and gender.

Comparing this overview with that presented on page 2, it can be seen that lupus pharyngis has been detected with striking frequency in younger individuals aged 15-24, with no less than 26.6% of patients in this age range having Outer skin lupus suffered from pharyngeal lupus. The 25-39 year age group has a significantly lower incidence of pharyngeal lupus (12.5%); the age of more than 40 years has about the same (12.8%) and the age of childhood has a slightly lower frequency (11.1%). If the 200 patients examined at the FINSENS Light Institute are divided into two main groups, so that one group includes individuals aged up to 25 years and the other includes patients aged 25 years and over , the result is that lupus pharyngis is approximately twice as often within the younger age group (23.7%) than within the older one (12.6%) - a ratio which corresponds exactly to that found when processing the same material in relation to lupus laryngis '). The fact that lupus pharyngis was detected far more frequently in younger than in older individuals is perhaps not only due to the fact that pharyngeal lupus primarily affects younger people, but also to the fact that the patients suffering from this disease die relatively early, a ratio which is already evident in the discussion of laryngeal lupus was highlighted; for there is hardly any doubt that the fact that the lupus disease also affects the mucous membranes points to a more serious form of lupus, which is more dangerous to the individual than the uncomplicated lupus of the outer skin?).

The overview shows that lupus pharyngis occurred in 13 males and 23 females among the patients with lupus of the outer skin treated in the FINSENS Medical Light Institute, ie 22.8% among the males and only 16.1% among the female patients. This indicates a higher incidence of pharyngeal lupus in males than in females, which contrasts with the higher incidence of lupus laryngeal in females found on the same material. The reason why the outer skin of the pharynx of male patients with lupus is more exposed to the attack of lupus might be found in the fact that in men this cavity is more exposed to irritative influences (tobacco smoking, use of chewing tobacco, abuse of alcohol, influence of certain occupations etc.) is exposed.

1) MYGIND: Lupus vulgaris laryngeal. Arch. f. Laryng., vol. X, p. 134

2) This assumption is confirmed by the fact that a review of the journals from FINSEN's institute found that no less than 5 among the 36 patients with lupus pharyngis died within 3 years after the examination (the No. 14, 15, 20 , 28 and 36 of the overview). A fact which is quite important in relation to the etiology of the pharyngeal lupus affection was established by the present study, namely that all patients with pharyngeal lupus suffered from facial lupus, which in no case was of a mild degree.

On the contrary, in most cases the facial lupus was of a very serious nature, both in relation to the extent of the affection and to its character (widespread formation of ulcers and scars, large defects of the external nose, etc.); a review of the journals 3 years after the patients had been discharged also revealed that in a striking number of cases their facial lupus tended to recur after treatment. The serious nature of the skin lupus in the affected patients was also shown by the fact that in 9 cases lupus also appeared in other skin regions and specifically in the regio colli (cases: Nos. 6, 11, 13, 14, 15, 18 and 21); the extremities were affected in 3 cases (No. 7, 18, 26), the truncus in one case (No. 11).

With regard to the facial lupus of the patients concerned, which in all cases was presumably the primary disease, it was also possible to demonstrate the supposedly significant relationship in terms of etiology, that in a striking number of cases the facial lupus had existed for a long time before the patient subjected himself to any treatment. It was shown that the average duration of facial lupus was around ten years (9.9), although the individuals examined all belonged to the younger age groups. In about half of the cases (Nos. 1, 2, 4, 8, 10, 13, 15, 18, 19, 23, 24, 25, 31, 32, 33, and 35) the facial affection had been ten years or more passed.

Etiological significance in relation to the occurrence of lupus in the pharynx may also be due to the fact that no fewer than 21, ie 58.3%, of the examined patients with lupus pharyngis also suffered from lupus nodules and ulcerations on the gingiva (No. 1, 4, 5, 6, 10, 13, 16, 17, 18, 19, 20, 21, 22, 23, 25, 29, 30, 31, 32, 34 and 36). The assumption seems justified that gingival lupus, which so often accompanies skin lupus, in many cases where it occurs together with pharyngeal lupus, arose earlier than the latter and could therefore perhaps play an etiological role.

On the other hand, from the fact that a little more than 1/3 among the patients with pharyngeal lupus did not suffer from lupus of the gums, it follows that the former in some cases does not arise by propagation of the lupus process from the mouth to the pharynx; in the remaining cases, moreover, it was only in exceptional cases that one could assume that the pharyngeal disease had arisen because the lupous process had propagated from the gingiva directly into the pharynx.

Furthermore, it was shown that all patients with lupus pharyngeal disease had lupus nodules or characteristic lupus scars or destruction of the nasal cavity, considering also the nasal vestibule as belonging to this region. In most of these patients the nasal lupus had spread somewhat into the cavum nasi proprium; but in only five of them could it be ascertained that the lupous disease had spread to the posterior part of the nasal cavity (mainly the posterior ends of the inferior conchae) and the posterior free edge of the septum, where there then developed either nodules or scars or Destructions of indubitable lupous origin were found. It should be noted, however, that in four cases a precise examination of the conchae could not take place; in relation to the three cases, the causes have been mentioned above (p. 2).

The five patients with lupous nodules, scars or destruction of the posterior part of the nasal cavity were classified as no. 8, 15, 19, 21 and 34. The overview shows that only three of these patients (No. 15, 19 and 34) had lupous changes in the rhinopharynx, which in all cases consisted of scarring, and among these three cases there was again one (No. 19) where the lupous process had not spread beyond the border of the rhinopharynx.

Since all patients with pharyngeal lupus present, even if widespread, ulceration of the portion of the pharynx susceptible to deglutition

explained that they felt no difficulty in swallowing, or, if there were any, that they were very insignificant, and since there were no other pronounced subjective symptoms of a pharyngeal disease, it could not be explained from the anamnestic way to what extent the pharyngeal disease was secondary to that in all cases of proven nasal lupus. There is, however, little doubt that this is how things are in the vast majority of cases; for it is a fact--which the present investigation, however, owing to the nature of the material fails to confirm--that pharyngeal lupus very seldom occurs primarily, while intranasal lupus, on the other hand, is frequently among the earliest lupusic manifestations

was

heard and often primary. The fact that lupus of the nasal cavity was observed in all cases indicates with certainty that intranasal lupus plays an etiological role in relation to lupus occurring in the pharynx, either directly or indirectly nature is. However, the underlying material indicates that pharyngeal lupus occurs only exceptionally in a way that can be considered to result from direct propagation of the disease of the nasal cavity; for, as previously mentioned, lupus changes in the posterior portion of the nasal cavity could only be demonstrated in five cases, and only in three of these cases was there a lupus affection of the nasopharynx. The correctness of this view is also supported by the fact that pharyngeal lupus is most frequently, and in a number of cases exclusively, localized on the uvula and the buccal surface of the velum palatinum, which will be discussed in more detail below, the mucous membranes of which represent a locality which has no direct connection with the nasal mucosa; the posterior surface of the velum is also extremely rarely found affected by lupus. Finally, it may be emphasized that in most cases of combined pharyngeal and rhino-pharyngeal lupus, this latter condition is most frequently such that it appears to be secondary to pharyngeal lupus and not to nasal lupus.

The explanation of how intranasal (and cutaneous) lupus spreads into the pharynx and oral cavity cannot yet be given, despite attempts made by various quarters, and these attempts will therefore not be discussed here. I should only like to draw your attention to a remark made as early as 1876 by E. Pontoppidan in his disputation. Pontoppidan seeks an explanation for the fact that lupus occurs relatively frequently on the mucous membranes of the nose, oral cavity, pharynx, larynx and conjunctiva, but rarely in the vulva, etc., by the fact that the first-mentioned mucous membranes also out of consideration for others Diseases show that they are more closely related to the outer skin; such as For example, it is about the same mucous membranes that can provide the location for the exanthema in variola and syphilis. These mucous membranes

adds the author - also have in common that they are exposed to the influence of the air and, on the whole, can be struck by some irritation, which can also strike the outer skin. The present investigation also shows, as will be shown later, that those parts of the pharynx which are less exposed to the direct influence of the air, namely the upper part of the rhinopharynx (as well as the posterior portion of the nasal cavity close to this region), and especially those to it The cavity-related posterior surface of the velum palatinum and the pars laryngea pharyngeus are seldom attacked by lupus, but the uvula and the anterior aspect of the soft palate (and the hard palate) are most susceptible to attack by lupus.

The significance of the intranasal lupus affection as the cause of pharyngeal lupus may, however, also be of a more immediate nature, and in particular two ways seem to present themselves in which the lupus of the nasal cavity can influence the development of lupus in the pharynx (and in the oral cavity)

1) Om Lupus, sarligt med Hensyn til Sygdommens Väsen og Etiologie, Copenhagen 1876, p. 17

could favor. In the first place, it is far from supposing that the intranasal lupus, which was very important in most of our cases, gave rise as a rule to nasal stenosis, and thereby to oral respiration, with the result that the pharynx (and oral cavity) become more airy than under ordinary conditions was exposed to irritant effects of the air. Secondly, it should be noted that the presence of the lupus nodules in the nasal cavity gives rise to the formation of a mucopurulent secretion, which, descending into the rhinopharynx and pharynx, and being frequently removed through the oral cavity, causes irritant conditions and nutritional changes in those below the nasal cavity overlying mucous membranes, just as so frequently occurs in other intranasal diseases connected with the discharge of mucopurulent or purulent secretion, whereby a favorable soil is then prepared for the lupous infection of the mucous membrane.

The fact that objective changes in the rhinopharynx were found in a striking number of cases in the 36 patients with pharyngeal lupus, which certainly indicated the presence of a more profound nutritional disorder of the mucous membrane in this region, speaks highly for the correctness of the latter assumption was found in a very large number of the 200 patients examined and which I cannot emphasize enough at this point. In no fewer than 16 patients, that is to say in almost half of the examined patients with pharyngeal lupus, the examination established an atrophy of the mucous membrane and particularly of the adenoid tissue of the same, in connection with catarrh of the rhinopharynx or else a pure atrophy without discharge of catarrhal secretion. In all cases in which a mucopurulent secretion was discharged from the pars nasalis pharyngis, the pars oralis was also completely or partially covered on its posterior surface by the outflowing secretion. In addition, three times one

. Pronounced ischemia of the mucosa of the oropharynx and pronounced granular pharyngitis twice.

After a number of etiological factors which are of importance with regard to the occurrence of pharyngeal lupus have been discussed above, namely in so far as the material on which the investigation is based has been able to illuminate them, it will now be appropriate to present the main results of the objective investigation of the pharynx (and the isthmus faucium); this will naturally be followed by a brief discussion of the large changes found on the anterior side of the palatinum molle and on the palatinum durum .

Rhinopharynx s. Pars nasalis pharyngis. Lupous changes of an unmistakable type were found in this region in eight of the cases examined (see overview on p. 4 No. 7, 9, 15, 16, 19, 20, 31 and 36). Since the rhinopharynx could not be examined for the reason mentioned on p. 6 in five cases not included in the overview and in three of those included, the percentage for the occurrence of rhinopharyngeal lupus is 4.2%. Besides, in two cases (Nos. 30 and 33) the mucous membrane was of such a condition that it could not be decided whether the lesion was due to the formation of a diffusely spread scar on the mucous membrane or to one caused by an atrophic catarrh

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called scar-like remodeling of the mucous membrane. The lupus affection consisted of nodules in two out of the eight cases (Nos. 20 and 36). In the first of these cases (No. 20), a cushion of nodules about 1 cm wide was found in the pharynx oralis to the right of the midline on the posterior and lateral walls, which also stretched up to the corresponding walls of the pars nasalis. as far up as the examining finger could be brought. In the same case, to the left of the median line, on the posterior wall of the oropharynx, there was a thick, shiny white scar about 1 cm wide, which resembled a vocal fold; for its midline edge was free and sharp, and the nodule extended somewhat below the free edge of the cicatricial cord, while the cord continued some distance up into the rhinopharynx. In the second case (No. 36) also the nodule formation in the rhinopharynx was a direct continuation of the nodule formation in the oropharynx, the posterior surface of which was quite covered with a continuous granular layer of ulcerated nodules the size of a poppy seed; this layer could be traced up as far as the examining finger, whose movements were greatly hampered by fissures at the mouth opening, could be brought in.

In the remaining six cases only lupular scars were found in the rhinopharynx. In two of these cases these stigmas formed the upper rays of a stigma star, the lower rays of which could be observed on direct inspection at the posterior wall of the oropharynx, and the center of which was at the junction of the two regions of the posterior wall (No. 9 1. 15). In one case, longitudinal, narrow scar strips appeared on the posterior wall of the rhinopharynx, which did not converge downwards but continued directly into similar strips on the posterior wall of the oropharynx (No: 7). In a fourth case (No. 31) the posterior wall of the pars nasalis pharyngis was transformed into a continuous chalk-white surface of scar, which was also the direct continuation of a similar surface of scar in the pars oralis. Only in the remaining two cases did the formation of scars in the rhino-pharynx have a more independent character. In one (No. 16) there was a transverse cicatricial fold at the top of the fornix, and in the other case (No. 19) the septum continued into a cicatricial crest, which after a course of ". cm cicatricial cords divided, which, concavity downwards, continued across to the lateral walls.) From this brief description it appears that lupous nodules occur rarely in the rhinopharynx (1.0° among all cases), that the lupous affections are most common in the occur in the form of scars, and that both the nodules and the scars are most commonly located on the posterior wall, and are mostly to be regarded as a continuation of the corresponding affections in the oropharynx.

Oropharynx s. Pars oralis pharyngis. In this cavity lupous diseases have not been detected much more frequently than in the rhinopharynx; only in 11 cases, ie 5.5° among all cases, were such found?). In addition, in two cases (Nos. 2 and 31) the mucous membrane of the posterior surface of the oropharynx had such an appearance

1) Among the above-mentioned 6 cases in which lupous scars occurred in the rhinopharynx, one (No. 15) showed slight adherences between the posterior surface of the velum palatinum and the rhinopharynx.

1) LELOIR found among 312 patients with lupus only 7, ie 2,200, with "lupus" of the posterior wall of the pharynx (1. cp 140).

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that it could not be decided whether it had given up the seat of diffuse superficial scarring from lupus.

Nodule formation could only be detected in three cases (ie 1.5° among all 200 cases). Two of these cases (Nos. 20 and 36) have already been discussed on page 16. In the third case (No. 4), at the same level as the basis linguae and a little to the left of the median line, there was a lupous infiltration somewhat larger than the size of a pea, which consisted of a number of nodules about the size of a poppy seed; at the center was a crater-shaped depression that could accommodate the tip of a probe.

In 10 cases (ie in 5 of all cases) scars of an undoubtedly lupus nature were found (Nos. 3, 7, 9, 14, 15, 20, 26, 29, 31 and 33). In two patients (No. 9 and 15), already mentioned on p. 16, the lower bundle of a stellate scar appeared on the upper part of the posterior surface, the upper bundle of which could be observed in the rhinopharynx, and its center approximately found a place at the transition point between the two regions. The scars resembled, in stellate structure and location, the scars formed from syphilitic ulcerations; but they differed from them in that they protruded less strongly on the surface of the mucous membrane, that they formed thinner rays, and that their appearance was less lustrous white. In one case the longitudinal scar strips mentioned on page 16 were found on the posterior wall (No.7); these, too, were less prominent, narrower, and less translucently white than the streaks produced by syphilis. In another case (No. 20), on the other hand, the thick band of scars about 12 cm wide, resembling a vocal fold, lying on the posterior wall, which was mentioned on p. 16, was of a translucent white color; its sharp edge faced the midline, while its lateral edge merged with the surrounding mucosa without sharp demarcation. In one case (No. 31) the whole posterior wall was transformed into a continuous chalk-white scar surface, which continued directly up into the pars nasalis pharyngeus. In one case it was level with the apex of the uvula

at the

posterior wall a small star-shaped scar (No. 29) and finally in two cases there were adherences between the lateral walls of the oropharynx and the posterior palatine arches (No. 30 and 33).

It follows, therefore, that lupous nodules seldom occur in the oropharynx, that the lupous affections present themselves most frequently in the form of scars, and that both the nodules and the scars find place almost exclusively on the posterior wall of

from there they often continue straight up into the rhinopharynx.

Finally, it should be emphasized that in no case were deep lupous ulcerations of the pharyngeal wall found; the lupus nodules only provided the seat for superficial ulceration formations.

The fact that the lupus affections in the rhinopharynx and oropharynx appear more frequently as scars, less frequently as nodules or ulcerations, finds its natural explanation in the fact that lupus in these regions tends to progress relatively quickly and result in scarring.

WHERE

Pars laryngea pharyngeus. In no case was lupus or lupoid x-scars detected in this section of the pharynx.

Arch of the pharyngopalatine. The posterior arches of the palate were the site of lupus nodules or scars in 13 cases, ie 6.5" out of all cases; LELOIR, on the other hand, found only two right lupus and two left posterior arch lupus (1st (c. p. 140). The affection was in most cases bilateral and symmetrical; only in two cases was the right palatine arch affected alone (Nos. 14 and 20). Nodules alone were found most frequently (Nos. 1, 4, 7, II, 36); these were sometimes the size of a poppy seed, sometimes the size of a hemp seed, and were most prominent on the upper part of the palatine arch; they clearly emanated from the base of the uvula, and this organ was in all cases, in which the palatine arches, the anterior as well as the posterior, were affected with lupus, except in one (No. 20).In two cases both nodules and x-scars were found in the pharyngopalatine arch (Nos. 3 and 14);in both cases found si ch the nodules above, the scars below near the pharyngeal wall. In several of the cases mentioned, the nodules were of a marked fibrous character, as proved both by their appearance and especially by examination with the finger. In six cases (No. 5, 20, 22, 26, 31 and 33) only scars were detected. In one of these cases (No. 22) the appearance of the posterior palatine arch was so little changed that it was only when the nasopharynx was examined with a finger that its scar-like nature was demonstrated. When the posterior palatine arches were partially or wholly cicatrized, each arch often formed a thick fibrous band with a blunt free edge; at the digital

pulled right

on

exploration, the ligament often felt remarkably hard and gristly. In one case (No. 5) the free edge was covered with knots; in one case (No. 20) the cicatricially remodeled right palatal arch was reduced to a short cord, which strongly trailed the uvula

In four cases the posterior were scarred

posterior palatine arch with its lower parts attached to the lateral and posterior walls of the oropharynx, so that the entrance into the rhinopharynx was diminished (Nos. 3, 14, 26, 33). In a single patient the pharyngopalatine arch and oropharynx were so closely fused that the examining finger could only be pressed up through the remaining opening with difficulty (No. 26), but in no case was the fusion so extensive that the nasopharynx was not could be examined with the index finger. In no case was the scar tissue formed the starting point for fresh nodules.

Tonsil palatine. According to HOMOLLES, lupus very rarely localizes to the tonsils. However, out of 312 cases, LELOIR found the right tonsil affected four times and the left four times. Both

Out of 200 patients at the FINSENS Light Institute, undoubted nodules were found only once (No. 22), and only on the upper part of the right tonsil.

Arcus glossopalatine. The anterior palatine arches gave the seat of lupous nodules or scars far less frequently than the posterior, presumably because they are in less intimate connection with the uvula; This was because in all the relevant cases, a total of seven, ie 3.5% of all 200 cases, was affected with lupus (No. 1, 4, 5, 11, 12, 25 and 31). In the examination of 312 patients, LELOIR found the right anterior palatal arch in eight cases and the left anterior arch in four cases with lupus changes. The lupous changes in the anterior palatine arches were most frequently bilateral and symmetrical in our seven patients; only in one case (No. 22) was only the left arch affected. In four cases (Nos. 4, 11, 22, 25) nodules alone were detected; these were small, irregular, and fibrous in appearance and touch. In two cases (No. 1 and 31) the anterior palatine arches formed cords of scars, which in one patient (No. 31) continued to the center of a scar star located in the middle of the soft palate.

base language. The tongue is so rarely involved in lupus disease that LELOIR found only one lupous condition of the tongue in a study of 312 lupus patients.

Among our 200 patients was one whose tongue presented lupus nodules, ulcers, and scars all over. The case (No. 31) was described in the Archiv für Laryngologie, Vol. X, p. 152.

only

Uvula. Next to the mucous membrane of the nose, the lips and the gingiva, the cone is the organ most frequently affected by lupus. Among the 200 patients in FINSEN's institute there were no fewer than 29, ie 14.5%, who had undoubted lupus changes in the uvula. This number is considerably larger than that stated by LELOIR, who found only 2.2% of 312 lupus patients with lupus of the uvula (1. c. p. 140). The lupous disease of the uvula is difficult to diagnose in its early stages, because in many healthy people

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In humans, this organ is edematous, swollen, stiff, and provided with bumpy or nodular protrusions on the surface. The uvula was in this condition in two of the 36 lupus patients named in the overview (No. 18 and 23), with the exception of a few lupus patients who were not included in the overview on pages 4-5, without me dared to decide whether or not the lupus process had taken hold of the uvula in these cases. In one case (No. 15) the uvula was found greatly shortened, but without any formation of scars, so that this case too must perhaps be counted among the doubtful ones.

Most commonly the uvula was so attacked by the lupus that it was entirely transformed into a conglomerate of prominent, quite regularly arranged, round, smooth, sometimes bright red, but most frequently pale red nodules, which in some cases were the size of a poppy seeds, but more often the size of millet or hemp seeds. In some cases the uvula had retained its natural shape but had become broader and longer; no contraction was evoked by irritation by the probe and by intonation, or only single stiff wrinkles appeared on the surface. On digital exploration, the uvula felt nodular, stiff; not infrequently the nodules felt fibrous or cartilaginous

In other cases the uvula was greatly shortened because its apex had been destroyed by ulceration; but now and then it was greatly increased in breadth, so that it had assumed the shape of a berry compressed from front and back. In a number of cases the destruction of the uvula was very important; in seven patients the organ was transformed into a uvula or was absent altogether (Nos. 9, 21, 24, 28, 30, 31, 35). In a small number of cases in which nodules and cicatricial formation were found simultaneously on the uvula, the cicatricial tissue was evidently the origin of the nodules, which relation, as O. CHIARI* points out, is characteristic of lupus on other mucous membranes.

With regard to the reason why lupus preferentially localizes to the uvula, we refer at this point to the theory put forward by E. PONTOPPIDAN, mentioned on p. 13, according to which the mucous membranes, which are preferentially exposed to the action of the air , seem to provide a favorable ground for lupus. The fact that uvula lupus is almost always associated with intranasal lupus must necessarily imply that these patients breathe through the mouth. On the other hand, there is hardly any doubt that other - and perhaps more important - causes are also present, which might have to be looked for in the morphological condition of the mucous membrane and especially of the epithelium of the uvula. Only if one assumes that this is the case, does the peculiarity that the tonsils, which appear to be no less than the cones of are exposed to external irritations, and which are in the immediate vicinity of them, are so extraordinarily seldom attacked by lupus.

Palatum molles. Velum palatinum. At 16 lupus

. patients, ie in 8 among all patients, lupous nodules were found on the soft palate,

1) CHIARI and Riehl, Lupus vulgaris laryngis. Quarterly publication for Derm. and Syph., 9th year 1882, p. 695.

out.

Ulcerations or their scars detected (No. 1 -5, 7, 10, 11, 14, 15, 18, 23, 24, 28, 31 and 35).

The lupus nodules were most commonly located on the anterior surface of the soft palate; often they were the size of a grain of millet and pale red, and they clustered on the middle portion of the anterior surface. Only rarely did they spread over the entire velum

Often they formed the direct continuation of the lupus nodules situated at the base of the uvula, and could then only extend a short distance forward and up the anterior surface. In some cases, however, they were found exclusively on that portion of the velum nearest the hard palate, and then proceeded directly into nodules on the palatinum durum.

On the soft palate the nodules were often ulcerated, but the ulcerations were in all cases superficial, and although in a few cases some nodules were seen on the posterior surface of the velum, in none was perforation found. In one case (No. 28) I had the opportunity to observe how the formation of an ulceration arises through the complete disintegration of the original nodules. In this patient, whose uvula is a small

, wart-shaped uvula with strong streaks of connective tissue, an ulceration about 14/4 cm long and 1 cm wide was found on the midline of the velum palatinum; the same, which was somewhat pointed in front, was entirely superficial, and at first sight resembled a catarrhal ulceration; but the edges were finely gnawed and existed, as one could clearly see

in a single spot a coherent circle of scarcely the size of a grain of millet, crimson nodules, around which there was again a border of crimson, swollen mucous membrane about 0.25 cm wide. If one looked more closely at this red, swollen border with a lens, one saw clearly that it too was formed by densely packed, slightly oedematous, swollen miliary nodules, some of which had already begun to ulcerate on the surface . The lens also showed that the uneven floor of the entire ulceration consisted of ulcerated nodules.

The lupous scars on the soft palate sometimes presented only as faint, irregular, pale streaks or lines on the mucosa (Nos. 10 and 24). In one case (No. 35) the scar formed a fibrous free margin, especially noticeable by touch of the finger, all over the soft palate, which was shortened in the anteroposterior direction. More widespread scarring was found in one patient (No.31); in him the palatinum molle was shortened in all directions and formed a tightly stretched fibrous diaphragm. The anterior palatine arches in this patient were transformed into two bands of scars, which met in the median line; From this point proceeded quite protruding cicatricial cords, diverging upwards and forwards, which, in connection with the anterior palatine arches, formed a cicatricial cord having the appearance of that often observed on the posterior surface of the oral pharynx (see p. 18). Finally, one patient (No. 15) had weak cord-like adherences connecting the posterior surface of the soft palate to the posterior wall of the rhinopharynx.

As already mentioned, perforation of the soft palate was not observed in any case; all previous investigators also agree that such destruction occurs very rarely.

Palatum durum. The lupus affections of this region will be briefly mentioned here because there is often a connection between them and the lupus changes in the soft palate. Among our 200 patients there were 20, ie 10%, with lupous nodules, ulcerations or scars of the hard palate. Among these 20 patients, 12 belonged to the group mentioned in the overview on p p. 2 were mentioned. The lupous changes occurred chiefly near the midline, and were most often most pronounced on the highest part of the hard palate; in a single case (No. 21) a perforation had developed at this point.

In the vast majority of cases the lupous affection of the hard palate appeared in the form of nodules, which were distinguished by being quite large, often the size of a hemp seed, or even larger and numerous; they formed continuous surfaces, which usually had their greatest distribution in the anteroposterior direction, but which also frequently winged out on either side at the highest part of the hard palate . The nodal groups of the hard palate were often flattened and provided with deep transverse wrinkles. They often stood in line to form knots

in direct contact with the soft palate and the part of the gingiva behind the front teeth; was by name

was

the connection with the last-named part frequently stands out, but often the two parts were also separated from one another by healthy mucous membrane.

The nodules were usually only superficially ulcerated and, as mentioned, ulceration extending down to the underlying bones was only found in one case (No. 21); it

This resulted in a perforation of the hard palate, which, according to the descriptions available in the literature, belongs to the very rare cases.

Cicatricial formations as a result of lupous ulcerations were found relatively seldom; the scars then appeared as pale, barely protruding lines of connective tissue. The lupus of the hard palate therefore seems to progress slowly and -- in contrast to the lupus of the pharyngeal wall - has no great tendency to form scars

Contribution to the investigations on the Durch

radiation possibility of the body.

Of

Gunnie Busck.

In the investigation of the ability of light to penetrate the tissues of the body, a number of experimenters have used various light-sensitive silver salts as sensitometers.

GODNEFF 1) filled capillary tubes with silver chloride, melted them shut, placed them under the skin of cats or dogs, and then exposed the animals to sunlight. It turned out that the silver chloride was blackened in the process.

ONIMUS?) obtained clear exposure to light on an orthochromatic plate when he exposed it by hand to unconcentrated sunlight. The thickness of the hand was 26-30 mm, the exposure time was 5 minutes.

FINSEN 3) attached photographic albumen paper (Aristo paper) to one side of a man's upper lobe and irradiated the ear from the other side with concentrated sunlight. After 5 minutes

1) cit. in BOUBNOFF: Archive f. Hygiene. Vol. X, p. 335.

2) E. ONIMUS: Penetration de la lumière dans les tissus vivants. Comptes rendus de la society de biology. Series 10, Tome 2, 1895, p. 678.

3) NIELS R. FINSEN: On the use of concentric chemical light rays in medicine. 1896, p. 34.

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long exposure the paper was not blackened; but if he made the ear ischemic by compression, blackening set in after 20 seconds.

SARASON) took a small silver bromide plate, which except for a star-shaped spot was completely covered with several layers of tinfoil, in his mouth, pressed the plate against the inside of the cheek and illuminated the corresponding outside for 1 minute with a 50 amp arc lamp whose Rays were concentrated by a Finsen apparatus (of 7 cm) -- using the pressure glass at the same time. -- When developed, the plate showed a clear blackening corresponding to the star-shaped spot.

SOLUCHA?) used tubes filled with silver bromide gelatin. Introduced under the skin of dogs, they were blackened in a minute by illuminating the dog with the rays of an electric projector of 10-20 amps and 50-65 volts.

On the other hand, if he inserted the tubes deep into the muscles, e.g. B. in the glutes, he received no effect.

DARBOIS 3) made a similar attempt as SAROSON and got the same positive result.

Finally, in the NY "Medical Record" -- April 1902, there appeared a communication from GOTTHEIL and FRANKLIN, according to which these authors achieved a powerful effect on ordinary photographic plates by means of rays that first hit the upper arm -- the shoulder area or even the abdomen of an adult built man.—An electric lamp of 60 amps was used as the light source, and the rays were collected by means of an unspecified reflector, and presumably they were parallel when striking the subject.

1) D. SARASON: About FINSEN's lupus treatment. Deutsche Medizinal-Zeitung, 1899, p. 15.

2) W RATSCH: No. 28, 1900.

3) DARBOIS: Traitement du lupus vulgaire suivant les indications. These, Paris 1901.

A photographic plate, e.g. B. in the lumbar region attached. — The back of the plate and the immediate surroundings were covered with black paper and cloth to exclude unwanted radiation and the electric light was now directed towards the abdomen so that the rays had to pass across one side of the abdomen (about 19 amps.) to reach the plate. After exposure for 30 minutes, a clear light effect was observed when the plate was developed. Positive results were also achieved through the shoulder region (approx. 16 cm) in 20 minutes and through the forearm (approx. 8 cm) in 10 minutes.

I made a similar series of experiments in the summer of 1902, and since my results differ greatly from GOTTHEIL's and FRANKLIN's, I find it justified to go into them more closely.

My experimental setup was as follows:

I placed (in the dark room) a sharp 3x4 cm photographic negative and a silver bromide plate (LUMIÈRE plates or EDWARDS' isochromatic plates) of the same size, layer sides facing each other, and held them together with copper sheet placed on the back of the plates and held has been bent over the edges.

I put them z. B. put the negative on the skin on the dorsal surface of my left hand and spread a thick layer of putty over it and over the skin on all sides. I managed to do it quickly and easily

from

convenient way to keep the panels in situ and protect them from unwanted light at the same time. That the latter was really successful was confirmed after each attempt by the fact that no diffuse blackening was observed when the plate was developed.

As a light source I used a carbon arc lamp of 70 amps and 50 volts. The rays were collected by an 8 cm FINSEN concentrator. I also used a rock crystal pressure glass placed 1 to 2 cm out of focus. After exposure, the plate was developed with Rodinal, and if the attempt was successful, I received a slide of the negative used. Instead of an ordinary negative, in the last experiments I used a negative with alternately completely transparent and completely opaque parts, because the contrast effect made it possible to recognize even the slightest blackening of plate II.

As a result of approx. 30 tests, positive results were obtained with EDWARDS' isochromatic plates in the following minimum times:

Through the middle of the hand (2.8 cm) i second,

through the thenar

(3.4 cm) 3 minutes,

Through the wrist (3.7 cm) 4 minutes.

With LUMIÈRE plates, the times were a little longer on average, but they resulted in e.g. B. but positive results through the hand (2.8 cm) in 5 seconds.

I have consistently received negative results

also with isochromatic plates with exposure through the forearm (5.6 cm), even with exposure times lasting more than 30 minutes, and I therefore considered it futile to attempt the fluoroscopy of still thicker parts of the body.

The cause of the large differences in the minimum times between the thinnest part of the hand and thenar and the relatively SO small differences in the minimum times between thenar and wrist must - in analogy to FINSEN's ear experiment - probably be attributed to the unevenness of the blood volume in the tissues (muscle or ankle). .

With concentrated sunlight I obtained an effect by hand (2.8 cm.) on isochromatic plates in 10 seconds. Most likely I could have gotten significantly lower times, but the attempts had to be abandoned due to persistently cloudy weather.

The rays acted on the LUMIÈRE plates used approximately from the D-line in the "yellow";

-“ EDWARDS' isochromatic plates are already reduced by red light. As will appear from another article in these communications"), the power of penetration of the red-yellow rays through animal tissue is greater than that of the others; besides, since we know of no more sensitive reagent for red-yellow rays than that of our retina, a direct investigation of the pellucidity of the various parts of the body provide the most reliable information as to how deep the visible rays of light are able to penetrate into the tissue.—In order to have the correctness of my experimental results confirmed, I therefore made the following experiments: I illuminated a spot on the dorsal side of a hand, for example with the same light as in the previous experiments and using the pressure glass, at the same time a metal tube was pressed against the appropriate spot on the volar surface of the hand, through the tube I could then see the light shining through the hand. The end of the metal tube which

1) GUNNI BUSCK: On the relative ability of the different spectral rays to penetrate animal tissue. Messages from Finsen's medical light institute.

IV

pressed against the hand was cuffed, a measure which proved necessary, lest light penetrate from the sides through the surrounding skin. The whole limb was thus examined in patches, with the following results.

A slide, using rays of light, showing a 2.8 cm thick hand

have happened. LUMIÈRE panel. Exposure time: 2 min

A strong, almost blinding red-yellow light shone through the center of the hand (2.8 cm). The light penetrating the thenar (3.7 cm) was much dimmer but still distinct. The wrist (corresponding to the wrist groove: 3.6 cm) was rather more permeable than the thenar, but the pellucidity again decreased sharply upwards on the arm, up to 11 cm above proc. styloideus, where no more visible rays penetrated. The arm was 5.6 cm thick at this point; I could still see a faint glimmer of light through 5.1 cm.

I repeated these investigations after placing in front of the cone of rays a filter containing 1/4 fuchsine solution, which allows only red rays to pass through. This light, too, was able to penetrate the forearm at a point where it was 5.1 cm thick.

In the article by GOTTHEIL and FRANKLIN discussed above, the concentration of the light is not described in detail, but since there is no mention of measures against the heat effect of the rays, it is not likely to be assumed that the light intensity was greater than that used by me .

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The authors also do not say which plates were used for the experiments - and, as is well known, photographic plates can be extremely different in terms of sensitivity (there are even plates on which the ultra-red rays of the spectrum act!). The authors mentioned believe that through their experiments they can offer the prospect of an effective phototherapeutic treatment of diseases of even the deepest internal organs. However, such a view is absolutely not justified by the present experiments. The fact that silver salts are acted on, in fact, only proves that red and yellow rays can penetrate through so-and-so many centimeters of blood-filled tissue. --- But the bactericidal, vessel-dilating, pigment-causing, inciting -- in short, therapeutic-physiological mode of action of light is primarily linked to the blue-violet and ultra-violet parts of the spectrum - i.e. precisely to the part that is characterized by a low ability to penetrate distinguished by its rays. On the whole, one can assume that the physiological effect of a type of radiation on a tissue is generally inversely related to its ability to penetrate.

That the positive results in the fluoroscopy experiments described above are exclusively due to an effect of the red-yellow part of the rays of the spectrum, and that the blue- violet part has no effect at all in the depths, which is discussed here following two attempts:

I mounted in the usual manner an EDWARDS isochromatic plate on the dorsal side of my left hand where it is approximately 2.8 cm thick. I then illuminated the hand from the volar side

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seconds long; but in the cone of light in front of the hand a 1.5% solution of double chromate of potash was appropriate. This solution, which was enclosed by plane-parallel glass walls that were 1.2 cm apart, allowed only rays with a wavelength of 700 uu to 541 uu (red, orange, yellow) to pass through. – During the development of the plate, a clearly positive result was found.

In the following experiments, the double chromate of potash was replaced by a 1.5% ammoniacal solution of copper dioxide, which absorbs the red-yellow part of the spectrum while allowing the blue-violet rays to pass. All other conditions were unchanged. The experiment gave a negative result, although the exposure time this time was 10 minutes, i.e. 120 times more than in the first experiment

Apart from the heat effect and the effect on the cells of the retina, we know of no or only very minimal physiological effects of the red light rays on the animal organism. (BIE") demonstrated that exposure to concentrated red light for a long time - 8 hours - was able to inhibit the growth of bacteria, while not killing them. It is well known that the red-yellow rays play a part in the metabolism of plants essential role, and the possibility must not be denied that they can also have one or the other physiological effect on the animal organism - but this must first be known before it can indicate a rational therapy!

1) VALD. BIE: Studies on the bactericidal effect of the different sections of the spectrum.

Communication from FINSENS med. Light Institutes, 1902, p. 72.

Studies on the ability of bactericidal

Rays of light penetrating through the skin.

Of

Hans Jansen.

The good results achieved with FINSESS phototherapy in bacterial skin diseases have led to many fantastic plans and proposals for light treatment in deep-seated bacterial diseases, e.g. B. in the lungs or in the abdomen. These proposals have also been based on observations of the permeability of tissues to light in general. It has been proven, among other things, that silver chloride paper, photographic plates, etc. are influenced by light,

, even after the same has passed quite thick tissue parts, even the whole body (GODSEFF, SOLUCHA, ONIMUS and others). But it must here be remembered that, firstly, it takes considerably less light to blacken silver chloride paper and plates than to kill bacteria, and secondly, that blackening may result from rays of considerable wavelength, even red ones, while the bactericidal effect is at work is essentially bound to the short-wave rays (proven in particular by WARD, FISSEN and Bie).

To prove the flaws in these proposals and to

In order to determine as conscientiously as possible at what depth we can expect the action of the bactericidal light rays of the strongest light presently used in phototherapy, I made a series of investigations, which at the same time had the purpose of determining which rays have a bactericidal effect in depth.

Indirectly, DE CHARDONNET) 1883 and WIDMARK ?) 1889 touched on this question by examining the absorption ratios of the media of the eye and demonstrating that even the cornea absorbs the greater part of ultraviolet rays and that they are influenced by tissues such as the nictitating membrane of chickens, Sclera or iris as well as lens are all absorbed.

In its first publication on local phototherapy, FINSEN 3) dealt with the question of "permeability of tissues to chemical radiation". With the help of silver chloride paper and spectroscopic investigations, he demonstrated that these rays penetrate more deeply when the tissues are drained of blood and showed experimentally that concentrated sunlight, after passing through an ischemic rabbit ear, was able to weaken bacteria and to kill (Bac. prodigiosus). However, he immediately rejected the assumption of a deeper effect of the light and gave as an indication for the method that the suffering must be local and superficial.

Since FINSEN's work, mainly concerning the experiments, which have been carried out with induction light and iron

I) DE CHARDONNET: On the penetration of actinic radiation in the oil of the human being and on the human beings and on the vision of ultraviolet radiation. Journal de Physique, Series II, t. II, 1883.

2) WIDMARK: On the influence of light on the front media of the eye. Scandinavian Archives of Physiology, Vol. I, 1889.

3) NIELS R. FINSEN: On the use of concentrated chemical light rays in medicine. Leipzig 1899.

light, several studies on the ability of short-wave rays to penetrate through the skin have been published.

In most of these treatises it has been shown purely spectroscopically how easily short-wave rays are absorbed by animal tissues. STREBEL 1) stated, among other things, at a lecture in Breslau in 1901 that urine absorbs ultraviolet light to the same degree as glass. With a quartz lens he concentrated the ultraviolet part of the spectrum (caused by his "induction spark light" with a quartz prism) on a rabbit ear, behind When a fluorescent screen was held, he saw no fluorescence, but saw the same when a piece of freshly prepared human skin was in front of it. This is not entirely understandable. I repeated this attempt; but even with very thin skin (mouse skin), through which ultraviolet rays pass, as I have shown elsewhere, I have not succeeded in observing any such thing. Opaque bodies, such as skin, do not allow bundles of rays to pass through as such, but are illuminated by them and the light spreads out diffusely from the opposite side. – DROSSBACH?) - also determined spectroscopically the absorption for the thin skin in a hen's egg and found that it began at 320 uu. From this he concluded that it is virtually impossible for bacteria that are only 0.1 mm below the skin's surface to be affected by ultraviolet rays.

The best are FREUNDS examinations 3) by

1) STREBEL: A contribution to the question of light therapy instruments. contract of the German dermatol. Society, Breslau 1901.

2) DROSSBACH: On modern light therapy. German med. Weekly, Sept. 21, 1901.

3) FRIEND: Contribution to the physiology of the epidermis in relation to its permeability to light. Arch. f. Dermatol. and Syphilis, Vol. LVIII, 1901.

led, and the same are all the more interesting because they are carried out under EDERS and VALENTAS aegis in the "kk graphic teaching and research institute in Vienna". Its light source was induction sparks between electrodes of EDER's alloy (lead, zinc, cadmium), which emitted a strong ultraviolet light. Using a ROWLAND grating, he formed the spectrum. He placed examining skin in front of half the column of the apparatus; if the spectrum was now photographed, he could see how much was cut off by comparing it with the uncovered half of the spectrum. Skin from burn blisters or pemphigus blisters and THIERSCH's lobules were found to absorb from 325 uu onwards, colorless horn from 328. Since the visible part of the spectrum ends at about 400 uu, one can see that only the outer ultraviolet rays are absorbed, the inner ones, from 400 uu to 325 ull, penetrate. But the outer ones are the most bactericidal.

Finally Baxg!) points out that the mere fact that light reaction is elicited on the skin by pure ultraviolet light suggests that this can in any case pass through the epidermis and reach the stratum papillare (he must, however, assume that the nerve endings in of the epidermis cannot be influenced), and he shows that ultraviolet light (BANG's iron lamp) produces the same effect on silver chloride paper as ordinary carbon arc light when passing only 1/10 mm of skin, but much less when it should happen skin by .

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German med.

I) S. BANG: Further experiments with iron electrodes. weekly, no. 2, 1902.

BOEDER?) carried out direct experiments on “light disinfection” in tissue. However, his investigations primarily concern light baths, the general effect of light on universally infected animals. Even if he had obtained positive results in such experiments, this proved nothing as regards light disinfection, since the result could just as well be attributed to a greater resistance of the test animal to light. But BOEDER also has a few attempts of a different kind: He injected a Strepto mixture

and staphylococci in the ears of an albino rabbit. One ear was exposed to a 20 amp arc lamp at a distance of 70 cm for 2 hours for 2---3 days while the other ear was kept completely covered. An abscess the size of a walnut appeared on this, whereas the exposed one remained undamaged. BOEDER is inclined to attribute this result to heat and the reaction to light. It is possible; but it is not excluded that there is a direct bactericidal effect of the light.

cocci

The best experimental method would probably be to place the bacteria protected against the action of the tissue fluids at different depths of the living skin, expose them to light under the same conditions as the clinic offers, and then inoculate to make sure whether the bacteria are killed or not Not. Experiments of this kind are carried out at the local institute by Dr. medical G. DREYER by inserting fine capillary tubes with bacteria into rabbit ears and then exposing them to light. However, since the experiments are quite difficult

1) BOEDER: On the question of the healing power of light. Work from the Imperial Health Office, Vol. XVII, 1900.

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and time-consuming, they have now been temporarily discontinued. Even

If they were carried out in this way, the values found in experimental animals could not simply be transferred to lupus or other pathologically altered human tissue. In all cases we must be content with approximate results.

So I just went about using freshly excised, shaved guinea pig skin and exposing the bacteria through it. I later extended these experiments to mouse skin and human cadaver skin. To all appearances such dead skin is less transparent than living skin, so that the rays of light most likely penetrate somewhat deeper into it than I have been able to prove. On the other hand, it is also possible that the living skin can offer stronger resistance, namely if it is not made sufficiently ischemic by pressure"). Incidentally, the following can be said about the skin used. Only white mice and white parts of guinea pig skin were used. Immediately after the animal was killed, the shaved skin was cut off and stretched on cork, as far as possible to its natural tension formol

1) In order to get an idea of the large or small difference in the transmission of dead or living but ischemic tissue, I made the following experiment: I squeezed the ear of an albino rabbit between the pressure glass and my finger,

X-rayed it and held silver-chloride paper behind it. The part of the ear used was cut off, stretched on cork (as described later), and used 1½ hours later for entirely analogous experiments. There was somewhat greater blackening from the living piece than from the dead piece. sated, since it turned out (experimental protocol No. 1-2, 5, 13) that this preparation produced no significant difference. In such cases the skin was kept on cork in tightly closed cans, in the bottom of which water and 3-4 drops of conc. Formol moistened cotton wool. The pieces of cork used were always wrapped in tinfoil, otherwise there was a risk of the skin tanning. I got the cadaver skin partly from the autopsy room of “Frederiks Hospital”, partly from “St. Johannes Stiftelsen". I hereby tell the Prosector Dr. medical I would like to thank PN HANSEN and the reserve doctors BORRIES and ASMUND JENSEN for the willingness with which they made the material available to me

Bjærgkrystalrude ten. This skin

wow

Bjærgkrystal was also used partly fresh and partly formulated. During the experiments was the skin

Natural size capsule. Cut. placed in a capsule, which consisted of two housings that could be pushed one on top of the other. They were squeezed just so hard that the skin was in medium came to rest in a tense state. The walls, which were immediately in front of or behind the skin, were made of rock crystal.

The tasks I set myself were as follows:

1. The depth at which the light develops a bactericidal effect in the tissue; finding the thickest skin through which concentrated electric light can kill bacteria (absolutely killing all bacteria attached behind the skin);

2. how deeply the weakening of the bacteria is felt when exposed to light;

3. To which spectral rays the bactericidal effect is linked at the different depths.

To do this, it was necessary to carry out many experiments with pieces of skin of different thicknesses. I obtained this using skin from different animals and from different parts of the body, namely: mouse skin, abdominal, side and back skin of guinea pigs, as well as skin of an adult human, partly from the lowest part of the front surface of the thorax, partly from the back and from the front surface of the forearm. In this way it was possible to obtain all possible thicknesses from 0.1-2 mm and in individual experiments with human skin, where I left the subcutaneous fat tissue on the skin, I achieved a thickness of up to 5 mm.

In some very isolated preliminary experiments, I used two or more layers of skin (that is, pieces of skin placed one on top of the other) in order to get a certain thickness.

The tests themselves were carried out in the following manner: the light source was an electric arc lamp of 70 amps, ca. 50 volts. As a rule, the intensity of the current varied only slightly (from 68 to 72), sometimes it could be more significant (from 65 to 75-80), but this did not last long. The light was collected using a Finsen concentrator with an 8 cm front lens placed 13.6 cm from the arc. With the resulting cone of light, the experiments were carried out slightly outside the focal point (12.5 cm from the lowest lens of the apparatus), where the light spot was 1.8 cm in diameter.

I) About its more detailed construction see: NIELS R. FINSEN: About the application of concentrated chemical light rays in medicine. Communication from FINSENS med. Lys Institute, Vol. III, 1903.

did. This powerful light is very warm; only the ultra-red rays are cut off in the apparatus. The temperature of the patch is about 190°. It was therefore necessary to achieve a completely sufficient cooling for the skin and especially for the bacteria. After a series of unsuccessful attempts (see p. 57) it succeeded

i.e

Natural size. Average. a capsule with skin; b the dried drop of bacteria; c quartz plate which is connected to d the tube by means of grease; e, a glass tube through which the jet of water is sent up; e, a second glass tube through which the jet of water passes over the front; | Pillar on which the capsule hangs.

was.

finally by the following arrangement: A small drop of broth culture of Bacillus prodigiosus was placed on a quartz plate the size of a coverslip 1) for drying (about bacteria and drying see below). This plate was glued to the mouth of a thick-walled tube with wax grease (see drawing above), so that the drop of bacteria was averted from the tube

A jet of water was sent against the quartz plate through this tube, which was closed in this way. The water bounced off it and ran back down the pipe. The wax grease, which remains hard and stiff when it cools down, binds completely so that the quartz plate is not thrown off. This, and with it the dried-up drop of bacteria, was constantly and vigorously cooled on the back. In front of or above the quartz plate, the capsule described above with the skin located therein was now attached. The quartz disc prevented the skin from lying directly on the bacteria, which would otherwise have been rubbed off the skin. Since the quartz disc was sterile and dry and the drop dried well, nothing or almost nothing stuck to it. Cold water also trickled down the front surface of the capsule to prevent burning the skin.

That this arrangement completely protected against the effects of heat was shown partly by the fact that fat (m.p. 30-359), even when blackened with pine soot, remained perfectly stiff and hard when placed on the bacterial site from numerous experiments with skin that was too thick or too impenetrable, where the bacteria lived despite prolonged exposure to light. However, if there had been no cooling, the heat would work through the skin. A blackened thermometer placed in the spot of light and sprinkled with water showed 29-30°, while without water it rose to 193°

1) It could just as well be glass plates; the fact that I used quartz is due to the fact that pieces of quartz of the same kind were present; and that the same are rather advantageous, since quartz is better at conducting heat (and therefore also “conducting cold ”) than glass.

2) It was a so-called "BBRGMANNs Rohr", insulating material for electrical lines, the inner walls of which consist of a wood-like mass, the outer walls of a metal cover.

With regard to the placement in the cone of light, it must also be noted that it was of course such that the rays fell perpendicularly on the skin, so that the bacteria lay behind it in the middle of the light spot. In addition, as can be seen from what has been said above, they lay directly behind the skin. For one cannot place the skin like a light filter on the path of the rays. As noted on page 39, the cone of light does not penetrate the skin as such, but illuminates it and the light spreads diffusely from the back. A distance of just a few millimeters will therefore be equivalent to an extraordinary weakening of the luminous intensity.

After the experiment, the capsule was removed with the skin. The quartz plate with the drop of bacteria was placed in a sterile PETRI dish, in the bottom of which was moist filter paper, and provided with a drop of just liquid nutrient agar. After staying in the thermostat (249) for 24 hours, it was then possible to see whether growth was present or not.

As mentioned, the microorganism used was Bac. prodigiosus. A 24 hour old broth culture was filtered and diluted with four parts water. I constantly used a certain small loop, by which the size of the drops deposited on the quartz plate became quite uniform. The drops dried over the course of 1/4-1/2 hour when placed in a Petri dish with the lid just lifted. From the time of preparation to the moment they were covered with nutrient agar, no more than 4-5 hours should elapse, otherwise the effects of desiccation could be felt. In all trials (except some of the first ones) one or more control drops were dispensed.

The solution to the first two questions: 1. the depth at which the bactericidal effect of the light is still active in the tissue and 2. the depth at which the weakening of the bacteria by the effect of light can still be felt, was now easily achieved by using ever thicker made skin experiments and set the longest exposure time at 75 minutes, the same time used here at the institute for the treatment of lupus. The tests that are of interest to us in this context are No. 12, 20, 21, 28, 30, 32, 33, 39, 40, 41, 47-50, 52, 53, 55 in the experimental protocol.

It will be seen from this that the greatest depth at which I achieved absolute kill in 5/4 hours is 1.8 mm, but this was only the case on a single attempt, 2 mm thick skin has consistently prevented killing. 1.5 mm thick skin usually allowed killing, sometimes after 40–50 minutes; but there were also cases where it did not occur. One can probably therefore call at most 1.5 mm as the greatest depth at which absolute kill can be achieved in 75 minutes, and kill cannot be expected deeper than up to 1.2 mm with certainty. It is not surprising that there are such great differences. Primarily this is due to it. lead to the fact that different pieces of skin, even if they are of equal thickness, may be more or less pigmented, have a more or less thick stratum corneum, or a more or less densely woven corium. In addition, the measurement of the thickness in and of itself can only be approximate (approx. 10 part accuracy). The lamp can burn unevenly, the setting on one day can be a little better than the next and finally the cultures can be different.

With regard to weakening, the experiments show that the greatest depth at which the effect could be observed was 4 mm (delayed pigmentation, slightly weaker growth than in the control); at a depth of 4.5 mm there was no effect, 3 mm strong effect and 2 mm very strong effect.

The solution of the third question was significantly more complicated: 3. To which spectral rays is the bactericidal activity at different depths connected. The most ideal would certainly be to use pure spectral rays of the spectroscope; but here the light is too much weakened. For our purposes one would have to have just as much ultraviolet, as much violet, etc., as oneself

u is in the cone of light from the concentrator, but that can hardly be achieved with the help of a spectroscope. I therefore had to use the absorption method, ie exclude more and more from the spectrum using known absorption media and see what difference arises. It will be appreciated that if through 0.1mm of skin one obtains kill after 3 minutes if all rays of light strike the same, but only after 6 minutes if glass is held in front of it Communications from Finsen's Medical Light Institute.

has indicated that the glass has retained rays which would otherwise have passed through the skin, in other words that the skin is permeable to the outer violet rays absorbable by glass. On the other hand, if on another piece of skin 0.8 mm. it is found that the shortest killing time is 22 minutes, whether glass is passed or not, it evidently means that these rays cannot penetrate said skin; if glass is in front, it blocks the rays; if no glass is in front, the skin blocks them; in none of the cases do they get to act on the bacteria lying behind the skin. By thus making comparative experiments, I have been able to find how deep the various components of the bactericidal rays reach the spectrum.

Before I go into more detail about the results, I still have to report on the absorption media used. I needed:

1. A glass light filter with distilled water, ie a rectangular glass box with plane-parallel glass walls. The walls were 1 mm thick, the layer of water through which the light should pass was 11/2 cm. This filter absorbed 1) all ultraviolet rays from 322 uu onwards. As is well known, the visible spectrum extends up to 400 uji. The ultraviolet rays, between 400 uu and 322 uji, therefore pass through glass, although they are certainly somewhat weakened, but unfortunately it is not easy to determine how much. In what follows I shall call these rays, that is from 400 uu to 322 uu, the inner ultraviolet rays, in contrast to those lying beyond 322 uu, which I will designate as outer ultraviolet rays;

1) The absorption of this and the following filter (the quinine filter) is from the physicist of the institute, Mr. cand. mag. ABSALON LARSEN determined. Emphasis was placed on using as strong a light as possible. A certain percentage of the light is absorbed for each spectral segment. When this is weak, it may happen that the absolute quantity which passes through a certain section is so small that it cannot be observed, while in strong light it is fully discernible. It is therefore not easy to allow the results obtained by means of spectroscopy with weak light to also apply to strong light. A 20 amp projection lamp was therefore used, the light from which was collected at a distance of 20 cm by means of a quartz lens and thrown onto the slit of the spectroscope.

2. A glass filter with acid sulphate of quinine, ie a glass case as I., but with a weak 1% sulphate solution of quinine. sulfur. The solution is freshly prepared, as a yellow compound forms quickly in the light and when standing (quinoidin?). This filter absorbed all of the ultraviolet light and very small amounts of the violet, namely 406 uu. This also undoubtedly weakens the adjacent violet section somewhat. The filters were in the beam cone, 2 cm

placed in front of the skin. As it is highly probable that some light is lost by reflection from the glass walls, in order to get the same conditions, I also attached a filter to the experiments where nothing should be absorbed, but of course with rock-crystal walls.

The experiments proceeded as follows: I sought to determine whether the external ultraviolet rays could pass through a piece of skin of a certain thickness, e.g. B. 0.8 mm (executed Vers. No. 45), so I first exposed through a

The absorption medium was placed between the lens and the slit. The spectroscope was a "ROWLANDS" grating and the spectrum was photographed on silver bromide paper, some with nothing in front, some with a glass filter and some with a quinine filter in front. When calculating known lines, it was possible to read exactly how many of the filters had completely cut off. Unfortunately, you don't get an overview of how much the other sections are weakened.

Quartz filter 26 min., then through a glass filter also 26 min., then through a quartz filter 22 min., then through a glass filter 22 min bacteria were as uniform as possible. Depending on whether the results in these two series were the same or different the next day, I got the answer to my question. I worked in the same way when examining whether the inner ultraviolet rays were passing, only here I used the quinine filter instead of the glass filter.

It now emerged from the experiments that with a very thin skin layer (approx. 0.1 mm) there was a significant difference in the effect, depending on whether glass was placed in front of it or not (experimental no. 1, 2, 35); the killing time was twice as long with the glass filter than with the quartz filter. This undoubtedly means that the ultraviolet rays can penetrate 0.1 mm thick skin, albeit greatly weakened. When bacteria are directly illuminated (i.e. without skin), there is a significantly greater difference, whether

shared the ultraviolet rays or not. dr medical S. BANG has shown by a series of unpublished experiments, working with pure spectral light, that rays with a wavelength of 220-240 uu are 200 times more bactericidal than those of 320-340 uu, and I have, in order to To see how things turned out under my experimental conditions, I made some experiments (Promise No. 19 and No. 36), which showed an effect for the total light that was 16 times as strong as for the external ultraviolet light. Therefore, if we find twice as strong an effect in 0.1 mm thick skin, this means that by far the

man

got to

most ultraviolet rays are already absorbed by this layer of skin.

At a thickness of 0.3 mm, the difference in the results with and without glass is even smaller (Promise No. 8). At 0.5 mm it is noticeable (ratio between the killing times: 9--10), but so insignificant that it is practically irrelevant (Promise No. 3, 14, 23, 54). There is absolutely no difference until 0.8 mm (promise no. 15, 24, 27, 29, 45). This somewhat lower effect for glass filters up to 0.8 mm is certainly primarily due to the fact that the glass filter, as I said, absorbs some of the inner ultraviolet rays in addition to all the outer ones.

It is quite different with experiments on ultraviolet rays with a large wavelength, which I call the inner ones. They seem to penetrate in abundance through not too thick skin. Namely, the kill time becomes significantly longer when you turn it off [eight times as large at 0.1mm (Promise No. 38 and 43), four times at 0.5mm (Promise No. 42), and only on the skin of something above 1.5 mm (Prov. No. 7, 9, 12, 25, 26, 31, 32, 37, 44, 50) the internal ultraviolet rays are also absorbed). Meanwhile, the effect of the blue-violet rays, which certainly also play a role in the thinner layers, becomes of greater importance the deeper we go, and at depths greater than 1.5 mm, where, with a single exception, I achieved attenuation these essentially due to these rays. It is probable that the penetrating power of the blue-violet rays is much better than that of the ultraviolet ones, and that they penetrate the skin in much greater quantity than the latter; but their bactericidal ability alone is not great enough to induce killing.

In the following table one will find a summary of all the kill times found for the various thicknesses of skin and the average or probable kill times derived therefrom. As mentioned on p. 42, due to the nature of the experiments and the material, no absolute time determinations valid for all cases can be expected. The times are all only approximate, but taken together they hopefully give a correct picture of the situation.

average

a or probably

All kill times found

in minutes

average a fod probably

in minutes

ok

9

75

bo

c. 0.1 (3)'), 3

3 (6)'), 6

6>14), 25

?

25 c. 0.3 8.6

78 c. 0.5 | 8,8,8, >8,9, 8, 8, 10, 10

30, 40, 40 40IO c. 0.8 15, >16, >15, >16, >40, >30 20, 20, 20,

20, 20, 22 20 > 20, 22 20 C. I 28

28 28

28 c. 1.275 c. 1.3 > 30, > 55,

> 10.65 60 c. 1.5 | 40, 45, 40, >10

40, 45, >45, 40, >45,

>60.75 60, 75,

>75, >75 75 c. 1.8 75, > 75

1) are from experiments 1 and 2, which were arranged in a different way; see test protocol p.

2) The sign > (greater than) indicates that the time given after that was not sufficient for the absolute killing of the bacteria, but was the longest time of the experiment. As a rule (where it is not a matter of purely orienting experiments) it will not be far from the correct killing time.

The relationships will become even clearer if we show the average times found in curves (see drawing).

minutes

75

70

65

60

55

50

45

40

35

30

25

20

15

10

5

I

II

20

2 3 4 5 6 7 8 9 10 12 13 14 15 16 17 18 19

tenth part mm skin.

Curve for the light collected (from 720 uu and below).

Curve for light - the outer ultraviolet rays (from 720

$\mu\ \mu$ -322 μμ).

curve for light all ultraviolet rays and some of the

violet (from 720 uu—406 uu). You can see how the curve for the collected light rises only a little at first: for every unit of time one goes down a good bit; but the further one goes to the right, the more it rises and ends almost vertically, ie increasing the time will cause the bactericidal action only a very small amount to go deeper. You will also see how close the curve is for the outer ultraviolet

Rays lie near the former curve, to finally coincide entirely with it, while the curve for all ultraviolet rays lies considerably higher, and does not even converge with them within the times here turned. Evidence that the outer ultraviolet rays play only a minor role in killing, while the inner ones play a major role.

on

Resume é.

The concentrated electric light can (under the given conditions) exert a bactericidal effect up to a depth of 1.5 mm and a weakening effect up to 4 mm.

This effect is due to the inner ultraviolet rays (from 406 to 322 uu) and to the blue-violet ones, while the outer ultraviolet rays (of a wavelength lower than 322 uu) are of little direct importance in killing the bacteria under the skin.

test protocol.

From March 11, 1902 to April 24, 1902, a series of attempts were made to find a reliable method. It has been shown that with the simple use of a rock crystal bowl with Koch's plate method (according to BUCHNER: black mark; lighting through the bottom) and skin placed over it, which was sprinkled with water during the lighting, heat killing was achieved as soon as the skin was more than 0 .5mm thick. The cooling water could then not penetrate through the skin into the bacterial shell. I therefore tried various ways to cool the culture from behind, sometimes with a direct jet of water, sometimes indirectly with a water-cooled glass plate, tinfoil capsule or metal tube, but everything proved impractical. It became necessary to abandon the Koch plate method completely and from April 24, 1902 I used the above method with dried culture drops on a water-cooled quartz glass plate. From the many attempts in the period from

March II to April 24, however, two were usable; namely, those with thin skins, where a simple sprinkle was enough.

No. 1.

17th April. Freshly cut abdominal skin of a mouse (approx. 0.1 mm), Koch's plate method from Prodigiosus (dense).

man

1) I.e. can just see where the spot of light has fallen, since the growth here is not as luxuriant as in the surrounding unlit part.

No. 2.

April 18th. The same piece of skin as in No. 1, but now formalized. Otherwise like no. 1.

Then, on April 24, 1902, the method described in the treatise was introduced. The conditions were essentially the same in all subsequent experiments. Only with the first (up to No. 18) did it happen that the dried bouillon culture drop absorbed moisture during the experiment and lay there like a small, clear drop, which completely changed the killing conditions. From June 3rd, however, this was prevented by a freer installation, so that no closed, damp space formed around the drop. Otherwise, the arrangement, distance, type of culture, age and dilution, power consumption and nature of the charcoal were completely the same in all experiments, so that I only need to mention what is special for each experiment, namely: type and thickness of the skin, Art of the filter and lighting times. Observation of the exposed drop was made 24 and 48 hours after the experiment. I classified the growth results in the following way: 1st v. W. = full, undiminished growth, as is the case with the Kon

1) This shows that the bacteria behind the black mark were also dead.

trolls proved; after 24 hours: a continuous saturated white spot under the clear agar; after 48 hours: the spot and, in the case of condensation water, the edge of the agar droplet are red. 2nd fl. W. Growth of the whole drop in the middle and edge parts, but weaker than 1 especially in the middle, not so saturated. 3rd black bottle W. = weak growth of spots, ie middle part very thin, only single colonies existing. 4. Rw.= marginal growth, ie the edge of the drop has grown, but the center has not. It always takes the longest time to kill the fringe; a wall-like accumulation of bacteria and salts has formed here during the drying process. 5th black Rw. = weak edge growth, except for a few colonies in the ring. 6. 0 = absolute kill, not a colony. As will be seen from the tables, there is often nothing seen after 24 hours, but growth after 48 hours, indicative of growth inhibition by exposure to light.

Other abbreviations used:

Q. Quartz filter (see p. 51). G. = glass filter (see p. 50). form. formolized (see p. 43). fr. fresh, ie either recently dissected or kept on ice. Min. Minutes. No. 3. April 24th, form. Abdomen skin of guinea pigs, approx.

0.5mm orienting. Min, filters

April 25th

26th of April

O?

bottle w (white)

15

G.

0

0

G.

G.

Q

0

O

7g

black Rw. black Rw. 5 q

bottle W

bottle W. 5 G. Fl. W

F). W

15

ok

10

No. 4.

April 28th, formed. Abdominal skin of mouse. Two layers, about 0.2mm.

No. 5.

Comparison between fresh and formolized skin. A piece of abdominal skin from a young guinea pig, approx. 0.3 mm, is used immediately after the dissection (April 28th), placed on it in formol vapor and used a few days later for an analogous experiment (Q series in experiment No. 8, 2nd May).

No. 6.

April 30th, formed abdominal skin of a young guinea pig,

0.3mm The same piece as in No. 5.

Attempt unsuccessful because the dried drop

got wet (see page 58).

Shape. belly skin of a guinea pig in two layers,

approx. 0.8mm.

No. 7

control

v. W

v. W

1) Apparently random infection as 30 min and 20 min indicate O.

No. 8th.

May 2nd, formed abdominal skin of a young guinea pig, approx. 0.3 mm.

No. 9. May 3rd, form. Abdomen skin of a guinea pig in

two layers, same as in No. 7, about 8mm.

No. 1o.

May 5, form. Back skin of a guinea pig, 0.6 mm. attempt failed. Heat killing because the water jet was too fine (partial blockage)

No. II.

May 6, form. Back skin of a guinea pig, two layers, ca. 1.5 mm.

v. W. v. W

control

v. W

No. 12.

9 May, formed. Back skin of a guinea pig, two layers, approx. 1.5 mm.

No. 13. May 12, comparison between fr. and form. skin. Abdominal skin of a guinea pig, approx. 0.5 mm

fresh

used on May 12th, then formulated in the same state of stress as possible and used on May 13th.

No. 14

May 16th, form. Abdominal skin of a guinea pig. about 0.5mm.

No. May 15, 26, form. back skin of a guinea pig,

0.7-0.8mm.

No. 16, 17 and 18 May 29, 30 and 31, very variable

and results inconsistent with the other experiments, which are due to the formation of drops during the experiment discussed on page 58. This disorder is from No. 19 on eliminated.

No. 19

June 3, direct kill time trials. The bacteria are attached in the same way, only no skin is placed in the cover capsule. Since one encounters times which are less than 1 second and these are not easy to measure directly, I tried it in a roundabout way and used a specially constructed apparatus for this purpose. Across the path of the rays I placed a rotating disc with a cut-out which was 15°, ie 1/24th part of the circumference. The light could only continue on its way while the clip was passing, so the bacteria received light only 1/24th of the time of the experiment; if you exposed 1 second, the bacteria got only 1/24 second light, if you exposed 12 seconds, they got 1/2 second light etc

3/

2 (with rotating shade)

do. do. do. do. do.

0

0

black bottle W

bottle W

bottle W

O

black bottle W

Fl. W

Fl. W

No. 21

5 June, formed. Back skin of a guinea pig, 3 layers, approx. 2.5 mm.

No. 22

June 5, formed. Skin of a guinea pig, 5 layers, about 4 mm.

No. 23

June 6, Fri. Back skin of a guinea pig, (preserved from June 4th), approx. 0.5 mm.

control

v. W

v. w (red)

No. 24

June 6, Fri. Back skin of a guinea pig (saved from June 4th), approx. 0.8 mm.

12

16
O
black Rw.

Rw.

bottle W. scbw. F). W. sw'. Fl. w. black bottle w. black Fl. w. 9 bottles V.Fl. w (red)

Fl. W

Fl. W. (red) 7 bottles W.Fl. w (red)

Fi. W.Fl. W. (red) 5 v. w (red)

v. W. (red) control

v. W. (red) no. 25. June 7, Fri. Human skin, 35-year-old woman. lowest

Part of the anterior surface of the thorax, about 1.5 mm.

v. W

v. W

v. W

minutes

quartz filter

glass filter

Quinine filter June 8th June 9th June 8th June 9th June 8th

June 9th

40
30

bottle W
bottle W

bottle W.Fl. W

Fi. W.Fl. W

bottle W.Fl. W

Fi. W.Fl. W

bottle W

bottle W

No. 26

June 9, Fri. Human skin, approx. 1.5 mm. (Ancillary piece to that used in No. 25).

.

No. 27. June 9 pm, fresh back skin of a sea

piglet, ca. 0.8 mm (preserved from 4 June).

O

O

Rw.

black bottle W

O

0 O

15

121)

Rw. black Rw.

2 col. black growth

91) Control 1)

O

0

i) These drops had settled in the morning and had stood up until the afternoon. The desiccation had caused damage.

No. 28

June 10, Fri. Human skin, approx. 2 mm (additional piece to 25 and 26).

No. 29

June 11, Fri. Back skin of a guinea pig, approx. 0.8 mm (reserved from June 4th).

No. 30

June 11, Fri. Human skin, approx. 1.3 mm, approx. 50 years old. Man. Lowest part of the front surface of the thorax.

No. 31

June 14, Fri. Human skin, approx. 1.5 mm (similar to that in No. 30).

1) Had been in a dry state for a long time (4-5 hours). In the following experiments, more emphasis is placed on this

ver

No. 32

June 17th, form. Human skin, approx. 1.5 mm (by the same man as piece in No. 30).

No. 33

June 18th, shaped human skin, approx. 1.8 mm (of the same as piece in No. 30).

0

bottle W

Rw.

FI. W

control

avoid, which is why the drops are discontinued according to use; about 1 hour before and for each time that drops are set, one is set at the same time as a control.

No. 35

June 20th, form. Skin of a white mouse, approx.

No. 36

20th June. Direct illumination through glass filters: thus no skin, but otherwise the usual arrangement (cf. No. 19).

2

1

3

6

0

O

4

O 3

O

O

bottle W

bottle W

Fi, W

bottle W

bottle W

1/4

FI. W

bottle W

June 21, form. Skin of a guinea pig.

Two layers, about 1.3mm.

4

1

2

No. 37

minutes

Quartz Siltter June 22nd

23rd June

Quinine filter June 22nd

23rd June

40

30

25

Fl. W?

bottle W?

F). W

bottle W

Fl. W?

bottle W?

bottle W

Fl. W

control

v. W

v. W

No. 38

June 21, formed. Skin of a white mouse, approx. 0.1 mm.

No. 39

21 July. Today we acquire from St. John
Pencil the skin of a 60-year-old. woman
a) 1 piece from the volar surface of the forearm.
b) 1 piece from the back.
With a, whereupon the subcutaneous fat in fresh
2 mm in total (of which the skin
approx. 0.8 mm), the following experiment:

No. 40. July 23, Fri. Human skin (back skin), approx. 2 mm

(No. 39 b).

minutes

24th July

bottle W

75 control c

v. W

bottle W

60 control

v. W

was not my intention higher than to 75

1) By accident, go there.

No. 41

July 23, form. Human skin (back skin) + subcutaneous fat (No. 39 b), 4.5-5 mm.

No. 42

July 25th, formed abdominal skin of a guinea pig, approx. 0.5 mm.

No. 43. 25 July, formed. Skin of a white mouse, approx. 0.1 mm.

July 28, form. Human skin, about 1.3 mm. The following experiments were also made with the same piece of skin:

No. 44

minutes

quartz filter

29th of July

quinine filter

29th of July

Rw.

Rw.

50 control

VW

Fi. W

bottle W

43 control

v. W

Rw.

39
control

Rw.
v. W

No. 45

July 29th, form. Human skin, approx. 0.8 mm (see No. 39 a).

No. 46

Shape. Abdominal skin of a guinea pig, approx. 0.5 mm.

No. 47. July 31, formed. Human skin, approx. 1.8 mm m. 48. Aug. 5, formed. Skin of a human, approx. 1.5 mm.

minutes

Quartz filter August 1 August 2

Fl. W

75 control

Ⱶ 1st week of W

v. W

No. 49. Skin of a 32 year old. woman Lower part of

front surface of the thorax,

a) with subcutaneous tissue (yellowish-reddish color).

approx. 4 mm;

b) Skin freed from the fat layer (approx. 1.2 mm.

Aug. 6, with a, fresh, ca. 4 mm (fat).

No. 50

Aug. 6, with piece b of no. 49, about 1.2 mm, the following:

scbw, Rw.

75 control

O v. W

v. W

No. 51.

Aug. 8th, fresh abdominal skin of a guinea pig, approx. 0.5 mm,

No. 52

12 Aug. New piece of skin from a 50 yr. very fat man. Lowest part of the thorax. So much of the fat layer is taken away that the thickness becomes approx. 3 mm (skin alone approx. 1.2 mm).

No. 53

Aug. 14, skin of the same man as in no. 52. So much of the subcutaneous tissue is taken away that the thickness becomes about 1.5 mm.

minutes

Quartz filter August 15

August 16th

Quinine filter August 15

August 16th

v. W

75
O

0

black Rw. black Rw. control

v. W.No. 54. Aug. 15, formed abdominal skin of a guinea pig,

about 0.5mm.

9
7

0 O Rw.

Oh black Rw.

0 black Rw.

Rw.

Rw.

Rw.

control

y, w

v. W

No. 55

29 Nov Fri Skin of a 50 year old. Male from the lowest part of the anterior surface of the thorax, approx.

1.5mm

minutes

Quartz filter November 30th

December 1

Quinine filter November 30 December 1

Rw.

bottle W

75 control

Rw.
v. W

bottle W
v. W

v. W

v. W

Of

Niels R. Finsen and Axel Reyn.

In the Light Institute we use a system for light treatment, which consists of a powerful electric arc lamp (50-60 amps) and four collectors placed in a circle around the lamp. In this way one achieves a relatively good utilization of the electric power. It is well known that a certain amount of current and potential gives more light if used in one large lamp instead of four small ones; moreover, the investigations of the institute's physics staff, cand. mag. ABSALON LARSEN, show that there is an equal relationship with regard to the amount of chemical radiation required for the treatment. This system must therefore be regarded as the cheapest and most economical and has therefore been introduced in most places abroad where our light treatment is used. But if this system is to be economical, it is of course necessary that four patients be treated at the same time; For this reason it will be particularly suitable for hospitals and larger institutes where there are enough patients; it will usually be too big for private doctors. In addition, ordinary electrical wiring is usually not large enough to support a 50 amp lamp, requiring expensive new electrical wiring. In many places this is causing great difficulties

caused and in fact has often been an obstacle to the introduction of light treatment.

To remedy this inconvenience, various apparatus for treating a single patient have been constructed. The first, or one of the first, was made by LORTET, Prof. at the Faculty of Medicine in Lyon, and his assistant Dr. GENOUDE made. This apparatus consisted of a 10 to 12 amp lamp mounted on a tripod, without a concentrator. The patient holds the diseased area close to the arc. A hollow metal screen is fitted between the patient and the lamp, which is cooled by the constant trickling of water through it. The light reaches the patient through a round hole in the shade with pressure glass.

Later a lot of different lamps and devices (about 20-30) were constructed, but as far as we know they are all significantly weaker than our big devices. One of the most ingenious of these new lamps from a technical point of view is that of Dr. BANG invented, but the light, which consisted mainly of ultraviolet rays, had the unpleasant property of not being able to penetrate deep; the light of the same penetrated z. B. 20-30 times as bad through a rabbit's ear as the light of our large apparatus. It is somewhat better in this respect with LORTET'S and GENOUDS' apparatus, which is one of the best of these new apparatuses; but in this respect, as well as in bactericidal power and in power to produce a skin reaction, it is considerably inferior to our large apparatus.

In order to remedy this deficiency mentioned above, and to satisfy the need for a cheaper apparatus for single treatment, we have constructed one of this kind, essentially on the same principle as the old ones. At our am

Tests carried out in the institute's laboratory have shown that it can do as much or almost as much as the old large devices and we can therefore recommend it to all those for whom the large devices are too expensive and not adequate for their purpose.

Our new apparatus consists of an ordinary self-regulating electric projection arc lamp of 20 amps and 55 volts, burning with carbon electrodes. The lamp includes a light-gathering apparatus. Both this and the lamp are on an adjustable iron tripod so that they can be mounted at different heights. The lamp rests on a "sled" so that it can be moved closer to and further away from the collecting apparatus. This whole arrangement is best seen in the figure above.

The collecting apparatus is constructed approximately like the large apparatuses, which are now all provided with water-cooling of the foremost lens (REYN), whereby the lens is brought much closer to the light

Average of a collecting apparatus. a mountain crystal lenses, b room for distilled water, c room for circulating,

ordinary water.

can without jumping. The new apparatus differs from the old only in the following modifications; it is made shorter for practical reasons and the lowest tube is not conical but cylindrical; moreover, the actual converging lens, which is placed just behind the foremost layer of water, is a Fresnel lens (see section of a converging apparatus attached). A lens of this type has the advantage over ordinary converging lenses that, with a shorter focal length than this, it is able to condense the light better and more evenly 1). Of course, the shorter focal length results in better utilization of the light, which increases the light intensity.

The Fresnel lens used by us has the peculiarity that only the central part, which is formed by an ordinary convex lens, consists of rock crystal, while the two prismatic rings around it consist of glass. It is well known that for the last four years we have only needed collecting apparatuses fitted exclusively with rock-crystal lenses to take full advantage of the ultraviolet rays of light, and the apparent break with this principle therefore requires further explanation. Some in the laboratory, namely by Dr. JANSEN's investigations have shown us that most of the rays, which penetrate deep and are capable of killing bacteria, can easily pass through glass if it is clear and not too thick. On the other hand, we know that it is necessary to have rays that do not pass through glass, but only through rock crystal, in order to achieve a sufficiently strong skin irritation. We have now convinced ourselves through experiments that a sufficient amount of ultraviolet rays passes through the middle part of our Fresnel lens, formed by rock crystal, to give the skin irritation the desired intensity. So without any detriment we can be the rings of glass

1) The lens, which is in front of FRÉSNEL's lens in the drawing, has accidentally been drawn strongly curved, while in reality it is very flat and therefore does not appear much more than a flat plate.

to let. This composition permits the use of a Fresnel lens, since it would be next to impossible, or in any case very expensive, to produce such rings from rock crystal. Of course, all other lenses in the apparatus must be rock crystal.

With the help of Fresnel's lens and with the help of the oblique position of the cones, which means that almost all light can be directed in one direction, we have succeeded in achieving the same effect with 20 amps as with the large apparatuses with their powerful lamps of 50 up to 60 Amp. The appearance of this new apparatus therefore means a great technical advance and will contribute greatly to making light therapy more accessible to practicing physicians. In hospitals and larger institutes, on the other hand, the large apparatuses will prove to be most useful, since they consume relatively less electricity and they take up relatively less space.

This apparatus is just as little patented as the old ones, but only provided with a trademark like these and is examined in the laboratory of the Light Institute and provided with a certificate. In this way, we have ensured that buyers get reliable devices.

Since it was intended that this apparatus should serve as a substitute for the weaker apparatuses which, because of their low luminous intensity, will sooner or later compromise phototherapy, or in any case prevent it from obtaining as favorable results as might otherwise have been possible we have made every effort to have the same manufactured and sold as cheaply as possible.

The action of light on amoebas.

Of

Georges Dreyer.

While the literature abounds with careful investigations into the effect of light on bacteria, yeast and mold, one finds only isolated and uninstructive observations of its effect on amoebas.

This fact is all the more striking since we are able to follow the smallest effects of light directly under the microscope and to obtain information about phenomena which must necessarily escape observation when bacteria are used as experimental objects.

That light of different qualities can either initiate or inhibit the movement of certain amoebas has not, as far as I know, been previously demonstrated.

Before I go into more detail about my investigations and their results, I would like to discuss ENGELMANN's interesting experiments with Pelomyxa palustris (GREEFF). This amoeba-like organism, 0.25-1 mm in size, consists of naked, colorless protoplasm. Kept in the dark, it moves briskly, while in sudden exposure (ordinary diffused daylight) it instantly spherically contracts. With steadily increasing notifications from Finsen's medical light institute.

IV

This phenomenon did not occur when there was a clearing or sudden transition from light to dark. ENGELMANY therefore states that the light acted as a sudden, strong irritation.

In the following I will first discuss my observations on the effect of different qualities of light on the movement of amoebas and then proceed to describe the ability of light to kill amoeba and their cysts.

1. The effect of light on mobility.

Unfortunately, since in most cases it has hitherto been extremely difficult or even impossible to separate certain amoebas from one another, I confine myself here to a few orienting remarks on the format used in these experiments.

The same is pure bred from stagnant, muddy fresh water. A 3% hay infusion is used for pure breeding and breeding, to which 1.5% agar is added. The food substrate is then placed on a PETRI dish and sterilized. Surface culture was consistently applied. By transferring the amoebas and the bacteria accompanying them from the agar surface to the agar surface, it was finally possible to obtain a pure culture of amoeba and a single one with the living, spore-forming bacillus. The amoeba form discussed here grows both at room temperature and at 37°, but the development of cysts into amoeba proceeds more rapidly at the latter temperature.

1) Whenever the term amoeba is used in this treatise, the amoeboid stage is perpetually, and the cystic stage is perpetually referred to as cysts.

The cysts are about 25 u in diameter, heavily pigmented brown and consist of an almost homogeneous content, surrounded by a double-walled shell, the inner wall of which is more or less strongly wavy, often six to octagonal, the outermost smooth and round.

The amoeba moves briskly even at ordinary room temperature, sending out pseudopodia of various shapes and lengths.

The nucleus is usually easy to see and the contractile vacuole is prominent. In the contracted state, the amoeba is about 30-40 uu. On the surface of hay agar or in hay infusion, the cysts develop into amoebas at 37° within 24 hours.

After 3-4 days, the amoeba encystes again.

The experimental arrangement was as follows: A suspension of a 24-hour-old amoeba culture was prepared in a dwarf test tube with sterile hay infusion and set aside for about 20 minutes. A few drops were then taken from the surface by means of a capillary, in order to avoid mixing with cysts which had sunk to the bottom during this time.

Three to four drops of hay infusion were then added to one drop from the capillary, and small drops were taken from this mixture and placed on the cover slip as hanging drops in a moist chamber. I used a low BÖTTKER's chamber, the bottom of which was covered with a thin layer of distilled water and two small indentations were made on the top edge to ensure free access to the oxygen in the air. The layer of water prevented condensation on the bottom of the humid chamber and prevented the droplet from evaporating.

There were usually three to four amoebas in each drop. A ZEISS was used for observation

cal oil immersion and eyepiece 3. The shape changes

Lys.

Gennemgaaende

05

60

06

00%

Rod glass

more

600 0

man

3

Performed.

Used as a light source

an electric arc lamp 12.5 amp.), outside the dun mounted in such a way that

the light through a circular opening 3.5 cm. diameter of one

from

Boelgelængde.

h 400MM

Darkroom wall fell. By placing differently colored glasses, the absorption ratios of which were precisely determined, in front of the opening in the wall, it was possible to change the quality of the light and, by moving the light source away or closer, to change the intensity of the light.

In this way one has secured oneself in a simple manner against the influence of other qualities of light than those with which one wishes to work in the given case.

Experiments were made with pure blue and red light produced by letting the light from the light source fall through blue and red glass. The absorption ratio of the glass can be seen from the attached curves, where the ordinate is the percentage of light that passes through and the abscissa is the wavelength.

The results obtained in the various series of experiments were, on the whole, so similar that I shall limit myself here to describing a single experiment in more detail.

As can be seen from the attached table, the results were as follows:

After the amoeba used for the study had been kept in semi-darkness for 20 minutes (the microscope mirror was turned upside down), it was exposed to white light for 5 minutes. After this time the observations and recordings began. In Fig. A, the movement fibers are resp. i', 1'50”, 2'40”, 3'50” 6', 6'45” and Observation. From this series it appears that the amoeba is in vigorous motion with retraction and expulsion of pseudopodia.

The movements seem to be the liveliest at first, since the changes in shape are hardly so clear after 6 minutes of observation, by downright

there is a tendency towards rounding and retraction of the pseudopodia.

After the 9 minutes had elapsed, the amoeba was kept in semi-darkness for 20 minutes, and after 5 minutes' exposure to blue light, the movements were observed again.

In Fig. B are the changes in shape after resp. o'40", 1'5", 1'25", 2", 3', 3'40", 4, 5', 6', 6'40", 7', 8', 8'40", 9'35" and 1o observation reproduced.

From this series one can clearly see that the movements here in the blue light are at least as lively and rather more lively than in the white light. The difference, however, is that while there the movements begin to diminish in vividness after only 6 minutes of observation, here in the blue light such things take place only after 9---10 minutes and do not show up nearly as clearly. The amoeba was then kept in semi-darkness for 20 minutes and then exposed to red light for 5 minutes. After this time, the movements were noted, which in Fig. C, after resp. 1'30", 3', 6', 9'30", 11', 12'30" and with observation.

When comparing the changes in shape in blue and red light, one sees clearly how sluggish and slow the movements in red light are, and how different they are from the lively movements in blue light, the amoeba in red light after 14 minutes, during which time it has been observed not changing its shape and showing very little tendency to shed pseudopodia.

After remaining in semi-darkness for 20 minutes, the same amoeba was again exposed to the white light for 5 minutes, and after this time had elapsed

I traced the changes in shape, resp. o‘45", 1'45", 2'30" and 3'30" Observation on (see Fig. D).

It is evident from this that, although the movements here are more lively than in the red light, they are not remotely so lively as in the blue light or in the white light at the beginning of the experiment (Fig. A). It is difficult to decide whether this lesser vivacity is due to habit or fatigue, but the greatest likelihood is the latter.

On closer observation of the changes in shape in white light (Fig. A), it is found that after about 6 minutes of observation the amoeba has assumed a form very near to that which it has in red light (Fig. C). There is now much to suggest that the uniform shape in these two cases is in all probability due to a different reaction on the part of the amoeba to the two qualities of light.

As far as experiments permit, the form in the former case seems to be caused by the fact that the white light, after having acted for a while as an incitement, finally begins to act as a noxious agent, against which the amoeba protects itself by an incipient contraction seeks. In the latter case, on the other hand, the form is due to the fact that red light of an intensity such as that in question does not seem to act as an incitement to the motility of the amoeba. That the red light does not have a harmful effect, to which the amoeba reacts with contraction, is clearly evident from the following investigations into the ability of different qualities of light to kill amoebas, which shows that even 2 hours of continuous exposure to red light of significantly greater intensity has no demonstrable deleterious effect on the viability of the amoeba.

From the above it follows that the amoeba-like Pelomyxa palustris (GREEFF) and the amoeba examined here behave very differently towards the action of light.

The former immediately contracted on sudden exposure and moved briskly in the dark.

The latter, on the other hand, never responded with momentary contractions, even when suddenly exposed to a light so intense it had the ability to kill them in 45-50 seconds.

It moved briskly in white and especially in blue light, but was slow to move in red light (in the dark).

However, it should be remembered that by no means all, but only individual amoeba forms are suitable for investigations of the type described here.

Of about 20 purely bred forms, some of which were certainly of the same species, only one of two proved useful for experiments in this direction.

In the following I discuss:

II. The ability of light to kill amoebas and cysts.

Exact investigations in this direction have not yet been carried out.

Researchers such as CELLI and FIOCCA) state, however, that amoebas in a moist or dried state

I) Centralblait for Bacter. and Parasitic., Vol. XV, 1894, p. 470

from

on

270 hours of sun exposure at a temperature of 12-15°.

The experimental setup for the experiments I was given was as follows:

I used an electric arc lamp as the light source. The light was concentrated using a FINSEN concentrator with rock crystal lenses. The diameter of the positive and negative carbon was 2.4 and 1.5 cm.

The tip of the positive carbon was 11.5 cm. away from the lens closest to it in the concentrating apparatus. I used 30 amps and 49-50 volts. The light rays fell at an angle of 45° to the horizontal and the exposed plate was perpendicular to the direction of the rays.

The same amoeba form was used here as in the previous series of experiments.

The shells used for exposure (humid chamber) were constructed as follows. The upper part (lid) consists of an approx. 6 mm. tall brass rings (B); in the uppermost edge of this, which is provided with a narrow cuff, is a round, 1.8 mm thick plate of rock crystal (A) of 3.9 cm. diam. The outer surface of the brass ring is provided with screw threads, by means of which the cover can be screwed onto the base.

In the ring there are also two diametrically opposed sections, 1 cm long and 2 mm wide. The lower part C also consists of a brass ring (B) of approximately the same height, which is provided with a narrow collar at the top and in the lowermost edge of which a rock crystal plate (A) of the same dimensions as the lid is set. The brass ring is internally screw-threaded and pierced in two opposite places (2 mm in

Diameter), suitable for any opening, is a 1.2 cm on the outside of the ring. long brass tube (D) of 2.2 mm. Soldered diameter. The rock crystal plates are airtight and watertight. A rubber ring (b) is placed between the cuff of the upper and lower part for the purpose of a tight connection. The height of the screwed bowl is 1.4 cm.

When using the shells for experiments, fill an approx. 2 mm. high layer of distilled water on the bottom. The suspension of the amoebas or cysts in sterile hay infusion was placed centrally on the inside of the rock crystal cover as a hanging drop, after which it was screwed tightly onto the base.

In this way, constant free access of oxygen from the atmosphere and prevention of the drying of the drop was achieved. In addition, direct microscopy of the illuminated drop was made possible, as the water layer made it impossible to dew the bottom.

The size of the drop was as uniform as possible in all cases, at its greatest thickness 0.5 mm.

A 24 to 30 hour old culture on hay agar was used for all experiments with amoebas.

After the hanging drop had been placed in the humid chamber, the chamber was left there for about 1/2 hour before exposure took place.

After this time, as a rule, only very few or no spherically contracted individuals appeared. The number of amoebas in each hanging drop was as a rule 30-40. An admixture of cysts in the experiments which were made with amoebae was avoided by allowing the suspension to stand for about 1/4 hour before use; as a result of this measure the cysts sank to the bottom.

The same suspension is constantly used for the same series of experiments.

v. B.

Lively amoeboid.

Unm, n. B. movements rather lively, single spherical

shaped contracted.

5-10 min. A.S. Some more individuals contraheret, the rest less lively. 24 hrs after exposure conditions more like before exposure,

quite like control.

v. B.

Lively amoeboid, a single rounded. Unm, n, B. Several individuals are rounded,

dilated vacuole. movements slower. 24 hrs n.b. Most clearly amoeboid and more likely

as before exposure, but possibly a bit more rounded than in the control shells.

v. B.

Lively amoeboid.
um n. B. Most rounded with strongly dila-

animal vacuole, some still clearly amoeboid,

but the movement is much slower. 24 hrs after B. Some of the individuals are back

amoeboid shaped but more rounded with dilated vacuole and only slightly mobile. Low propagation

Table I continued.

trial

Be.

clearing

time

in minutes

test result

number

v. B. Lively amoeboid.

um n. B. All with a few exceptions

dilated vacuole contracted.

24 hours n. B. With very few exceptions

are all killed. Most are spherical, somewhat swollen with dilated vacuole; with single granular decay. The few survivors rounded off with very short pseudopodia. v. B. Lively amoeboid. um A. B. Almost all with greatly dilated vacuole

contracted, which, which still amoeboid form

have seem immobile. 24 hrs n. B.

Only very isolated ones or none live at all, they are strongly rounded with a dilated vacuole.

v. B. Lively amoeboid.

um n. B. Most are rounded or spherical

shaped contracted; with statker or even maximum

contracted vacuole and only in a few cases

with a dilated vacuole. 24 hrs nb All without exception killed. They are

partly round, partly granular, with more or less distinct exoplasm. Only the core is left of some.

60

v. B. Lively amoeboid.

Umn. n. B. A large part is spherical contra-

(3)

heret, others are amoeboid in form, but the pseudopodia appear stiff and immobile.

With many already granular decay. 24 hours to B.

All killed without exception.

(27)

control

Lively amoeboid both the same as at 24 hours

later observation.

Water was sprinkled over the dishes during the exposure, thereby excluding the heat effect. The subsequent procedure usually consisted in the exposed drops being examined under the microscope immediately before and after exposure, and 24 hours later.

Unexposed control dishes were constantly placed next to the exposed dishes.

Experiments were further made to demonstrate the power of resistance, both of the amoebas and of the cysts, to concentrated light of varying quality. As far as the amoebas are concerned, the results, as can be seen from the attached test table, were as follows:

From Table I, where exposure was made through rock crystal, it can be seen that with very short exposure times ɔ:5 seconds, the amoeboid movements are more lively immediately after exposure is complete, and only very isolated individuals appear contracted 5-10 minutes after At the end of the exposure some more numerous, rounded individuals are noted and the movements can be described as lively. After storage for 24 hours at ordinary room temperature, the conditions are almost the same as before exposure, insofar as the amoebas are again in lively motion, sending out numerous pseudopodia. After 15 seconds of exposure, several rounded individuals are found immediately after completion, the contractile vacuole is somewhat dilated and the movements are rather sluggish. In an observation 24 hours later, this influence has in the meantime been completely neutralized again, in that the majority of the amoebas, although they still show a certain tendency to round off, are clearly amoeboid.

After 30 seconds of exposure, most of the amoebas are rounded, with a greatly dilated vacuole, some still have retained the amoeboid shape with pseudopodia, but the movements have, so to speak, stopped. 24 hours later it shows that part

. of the rounded forms is again amoeboid in shape, but they are only slightly mobile and significantly more rounded than before exposure. The contractile vacuole is still dilated.

After 40 seconds of exposure, all but very few individuals are rounded or spherical in shape with a dilated vacuole contracted. When inspected after 24 hours, part of the amoebas has disappeared, consumed by the bacteria. This can be seen from the luminous, round parts the size of an amoeba, in the middle of which one finds the remains of the nucleus and absorbed bacteria or bacterial spores.

The remaining individuals are either spherically contracted or granularly disintegrated. By this time, as can be seen, most of the amoebas have perished as a result of exposure to light.

After 45 seconds of exposure, the ratios are even more pronounced, and when observed 24 hours later, almost all individuals are found to have been killed.

After 50 seconds of continuous light exposure, most are rounded or spherically contracted. In most cases the vacuole is severely contracted, and in some cases it is extremely contracted. Only a few amoebas have dilated vacuoles. 24 hours later, all are killed without exception.

After 60 seconds of exposure, one part appears spherically contracted, others have retained their amoeboid shape with pseudopodia which, however, appear stiff and immobile. Many are already in granular decay. 24 hours later the signs of destruction are even more pronounced.

The picture presented by light-killed amoebas 24 hours after the killing exposure has taken place is often quite different. Part of the individuals is spherically contracted with dilated vacuole and sharply defined exoplasm, others are quite clear, somewhat swollen with fine-grained protoplasm and rather contracted vacuole, while the outlines are often only faintly indicated. Others lie in equally luminous, rounded spots (shadows), so that it is often impossible to distinguish the outlines. Only an immersion lens can be used to determine that the remains of an amoeba are really involved in these cases. These are disintegrated or consumed amoebae, which are visible as light-colored areas with the remains of bacteria and bacterial spores in the middle

are watching. Whether the glowing part, which is relatively poor in bacteria, is caused by the fact that the invisible, but possibly still existing exoplasm keeps the bacteria away, or whether it is a question of negative chemotaxis, which

bacteria and spores ingested and partially consumed by the amoebas on the surrounding bacteria is difficult to decide; however, the latter is absolutely not excluded

Ղ u

Table II. Amoeba experiment (exposure through clear

Glass).

trial

loading

clearing

time

in minutes

test result

number

v. B.

Lively amoeboid.

um n, B. Most are rounded with dila-

animal vacuole. Numerous still with amoeboid

form, appear alive but only slightly mobile

to be. 24 St. n. B. Only a few rounded, almost all live

haft amoeboid with dilated vacuole and many processes, none dead.

v. B. Lively amoeboid.

um n. B. Most are rounded with dila-

animal vacuole, some still more amoeboid
shape, but very little or possibly none

not movable. 24 hrs n. B.

All but a single exception killed, either rounded or granular decay with indeterminate demarcation.

v. B.

Lively amoeboid.
um 11. B. Almost all are rounded or contracted.

There are, however, some with indefinite
Differentiation from amoeboid form; They seem
in the beginning, coming decay, Be-

movements are not detectable. 24 hrs nb All are killed and badly destroyed.

Control movements lively amoeboid, both same as with

the 24 hour later observation.

Tables II and III show that the killing effect of light on amoebas is due to ultraviolet rays, which are particularly effective.

IV

Table III. Amoeba experiment (exposure by blue

Glass)

loading
experimental clearing.
number

time
in minutes

test result

v. B. Lively amoebaid.
um n. B. Only some are rounded with dila-

ted vacuole, the rest with amoeboid shape
and rather more lively in the movements than before

Exposure 24 hours a. B. Only a very isolated one is spherical

shaped contracted (also frequently observed in the control shells). Lively amoeboid. More proliferation than in the control.

v. B. Lively amoeboid.

um n. B. Numerous spherical contracted with

dilated vacuole. A part constantly clear

amoeboid, but more rounded and slower in the

movements. 24 St. n. B. Very isolated ones are rounded off,

almost all vividly amoeboid with numerous pseudo. podia and dilated vacuole. Those killed cannot be ascertained. Lively reproduction.

v. B. Lively amoeboid.

um n. B. Most are contracted, a part

however, is still amoeboid in form, albeit the

Pseudopodia short, partially retracted and erect

are pointed. Several are heavily granular with maxinal

contracted vacuole and possibly already in incipient decay. 24 hrs n. B. All but one exception

killed.

vb

Lively amoeboid.
um n. B. Most are spherical, some

yet amoeboid shaped, but appear immobile.

Many with strong or maximally contracted vacuole. 24 hrs n. B.

All killed without exception. The destruction process is very pronounced.

Table III continued.

trial

loading
clearing

time

in minutes

test result

number

Lively amoeboid both same and after 24 hours

put down.

white and blue glass has taken place (see p. 84 for absorption ratios). From Table II it can be seen that after 5 minutes

5 long exposure most individuals with dilated vacuole rounded, but many are still amoeboid in shape but only slightly mobile; dead ones are not to be observed!

After 10 minutes exposure, most are rounded, but some are still amoeboid in shape but have little or no mobility. When observed 24 hours later, all but one are killed.

After 15 minutes long exposure all are killed.

From Table III, where the exposure is made through blue glass, it is seen that exposure for five minutes affects the amoebas but little, being quite a few with dilated vacuoles rounded, but most being briskly motile.

24 hours later they are more lively in their movements than in control, also they seem to have multiplied more.

After 10 minutes exposure, many are spherically contracted, but one part is still clearly amobeoid in shape, albeit more rounded than before exposure.

24 hours later, all the amoebae are observed to be moving vigorously again. Propagation is more plentiful than in the control. There are no deaths to report.

After 15 minutes exposure, most are contracted, but some still show pseudopodia of short and distinctively pointed shape. Several are heavily granular with extremely contracted vacuoles and so may already be dead. 24 hours later all are dead except perhaps one. The image is almost comparable to what you get with a 10 minute exposure through clear glass.

After 20 minutes of exposure and subsequent observation 24 hours later, all individuals are also killed.

If, on the other hand, the exposure is made through red glass, which keeps out all so-called chemical rays, it is found that even 2 hours of exposure has not the slightest harmful effect on the vitality and vitality of the amoebas. Immediately after exposure they appeared to be as motile as before, and 24 hours later behaved exactly as in the unexposed control, even as far as proliferation was concerned.

If you now set the killing time for amoebas with exposure to rock crystal to 45-50 seconds, through clear glass to 10-12 minutes, through blue glass to about 15 minutes, you can see that the killing is 13-14 times faster , when exposure is made through rock crystal instead of clear glass, and 18-20 times faster than when exposure is made through clear glass, so that the ratio becomes:

Rock crystal: clear glass=1:12-14,

Rock crystal: blue glass=1:18-20.

= Having set the killing time for amoebas in this way, it was of interest to konsta animals how the killing time related for the same amoeba in the encysted stage.

For these experiments I used cysts which came from a 3-month-old culture on hay agar. The procedure in these experiments was as far as possible the same as in the experiments with the amoebas.

The exposed drops of the cyst suspensions were, as far as could be done, of the same size and thickness.

Each drop contained about 30-40 cysts and no amoebas. After exposure, the dish (humid chamber) described earlier was placed in the thermostat at 35-37°. The observation took place 24 hours after exposure. Suspension in hay infusion was always made immediately before the series of experiments began, and the same suspension of cysts was used consistently in the same series of experiments. At the same time as the exposed dishes, a control dish was placed in order to safeguard against defects (such as excesses, etc.). Table IV. Cyst experiments (illumination by Berg

crystal).

trial

loading

| clearing

time

test result

number

50 sec

vb

No amoebas. 24 hours a. b. Abundant development of cysts

(3)

lively mobile amoebas. Development rather more plentiful than in the control. No spherical individuals.

(3)

65 sec

do.

(2)

80 sec

do.

(2)

100 sec

do.

62)

125 sec

do.

v. B. No amoebas.

24 hours a. b. Abundant development lively

mer amoebas, almost as in the control.

v. B.

No amoebas. 24 hrs a. B. Hardly as many cysts to amoebae out

grown as in control.

vb

No amoebas. 24 hours n. B. Only very few cysts are closed

Amoebas fully grown, while very abundant growth is evident in the control dishes.

v. B. No amoebas.

24 hrs a. b. Not a single cyst is associated with the amoeba

fully grown while developing profusely in

the control shells.

No amoebas originally, but 24 hours later

in the thermostat at 37°, plentiful development of cysts into amoebas (about 15 of those present).

From Table IV, where the exposure is through rock crystal, it is seen that exposure for 9 minutes neither kills nor weakens the cysts, the development into amoebas proceeding here as vigorously as in the control dishes.

Only after 12 minutes of exposure does a harmful effect begin to show itself, which manifests itself in the fact that a few cysts, as in the control dishes, develop into amoebas.

After 20 minutes of continuous exposure most have lost the ability to develop, and 24 hours later very few are found to have grown into amoebas.

If the cysts are exposed for 30 minutes, they have all lost the ability to grow out.

In order to guard against mistakes which are often made when it comes to determining the difference between the resistance of the vegetative forms and the spores of bacteria to the action of light, I have made the following control experiments to demonstrate that in the liquid , in which the cysts were swollen under the exposure, did not form any toxic substances which could possibly prevent the cysts from growing out.

Drops of hay infusion were exposed to light for periods considerably longer than those used in my experiments, then seeded with cysts and placed in the thermostat at 37°. It has now always been shown that the growth of cysts into amoebas proceeds just as vigorously in the first exposed and seeded drops as in the unexposed ones.

From Table V, where exposure is made through clear glass, it appears that exposure for 30 minutes does not reduce the viability of the cysts, while exposure for 40 minutes does so

comparatively few cysts were capable of development, so that a far smaller number were found to have grown into amoebas than in the control dishes.

0

Table V. Cyst experiment (exposure through clear

Glass).

trial

loading

clearing

time

in sec

test result

number

v. B. No amoebas.

24 hours a. b. Abundant development of cysts

Amoebas, almost as in the control.

v. B. No amoebas.

24 h. a. b. Abundant outgrowth of cysts

Amoebas, but apparently in a somewhat smaller number

number fully grown than in the control.

v. B.

No amoebas. 24 h. A. Only relatively few cysts

Amoebas fully grown and in far fewer numbers than the control.

vb

No amoebas. 24 hours n. B. None or only a very isolated one

Cyst developed into amoeba.

VB No amoebas.

24 hrs AF No cysts have grown into amoebas.

Constant profuse development of cysts into amoebas

after 24 h at 37o.

After 60 minutes exposure almost all cysts are killed, only a single, more resistant one being able to grow into an amoeba.

After 70 minutes exposure, all cysts are killed.

From Table VI, where exposure is made through blue glass, it appears that exposure for 40 minutes does not demonstrably alter the cysts, and that even after exposure for 70 minutes there are quite isolated ones capable of growing into amoebas.

Table VI. Cyst experiment (exposure through blue

Glass).

1

trial

loading

clearing

time

in minutes

test result

Quantity

v. B. No amoebas.

24 h. A. Numerous cysts developed into amoebas,

an equal number as in the control.

v. B.

No amoebas. 24 h. A. Individual cysts developed into amoebas, however, only a small fraction relative to that developed in the control, and in some experiments only a single cyst is fully developed.

v. B.

No amoebas. 24 hrs. n. Not a single cyst to the amoeba

mature.

Abundant outgrowth of cysts into amoebas

24 hour standing at 37o.

On the other hand, after 80 m.

A single experiment is performed with exposure through red glass and a 3 hour exposure proved to have no demonstrable effect on cyst viability.

Assuming the killing time for cysts to be about 25 minutes by exposure to rock crystal, about 60-70 minutes by clear glass and by blue

well

:

glass for about 70-80 minutes, it turns out that killing by exposure to rock crystal proceeds 21/2-3 times as fast as by clear gas, and 3-3' ma as fast as by Exposure through blue glass, so that the ratio for cysts is as follows:

Rock crystal: clear glass = 1:24/2—3, and rock crystal: blue glass = 1:3—(3/2).

If one now compares the killing times found for amoebas and cysts, it appears that the cysts are far more resistant than the amoebas. On the other hand, if one were to specify how much greater the resistance of the cysts is in comparison with that of the amoebas, the result depends to a large extent on the qualities of light to be compared.

It turns out that the cysts are 30-33 times more resistant than the amoebas to light through rock crystal, 5½-6 times more resistant to light through clear glass, and finally to light through blue glass the cysts are 5 times more resistant as large as that of the amoebas.

From further consideration of the killing times found, it follows that while the amoebas are killed by exposure to rock crystal 13-14 times as fast as exposure to clear glass and 18-20 times as fast as exposure to blue glass, the ratio for Cysts are quite different, in that they are killed only 24.-3 times as fast when exposed to light through rock crystal as when exposed to light through clear glass and about 3 times as fast as when exposed to light through blue glass.

This now shows that amoebas are 5-6 times more sensitive than cysts to the rays that pass through rock crystal (ɔ: the ultraviolet, + visible part of the spectrum).

The reliable reason for this strange phenomenon can hardly be given at the moment. However, since we know that the outer ultraviolet rays (3: those that pass through rock crystal) have relatively little penetrating ability compared to the inner ultraviolet, violet and blue (3: those that pass through clear and blue glass) and now that the cyst envelope is pigmented brown and relatively thick compared with the clear exoplasm of the amoeba, this may be the reason why the amoeba are much more sensitive than the cysts to the rays which pass through rock crystal.

In conclusion, I would like to remark that it has never been possible to destroy the bacteria or bacterial spores accompanying the amoebae without killing the amoebae or cysts at the same time. However, it is not entirely impossible that we can produce pure cultures of amoebas without living bacteria in this way.

There may also be an opportunity to separate forms that appear to be completely similar, both morphologically and culturally, by exploiting the amoeba's different sensitivity to light.

However, the attempts made in this direction have not led to any reliable results up to now.

About the relative penetration ability of the different spectral rays against animal Tissue.

Of

Gunnie Busck.

The great importance of knowing the degree of permeability of the tissue for light rays for practical light therapy was already emphasized by Finsen in his first publication on the therapeutic use of concentrated light). Experimental investigations into the permeability of a blood-filled and blood-empty rabbit's ear to chemical rays led him to use pressure glass in light treatment. The constantly growing spread of light baths of very different kinds, especially abroad, in recent years also requires more scientific justification than has been done up to now. But such a justification requires a more precise knowledge of the penetrability of the different types of radiation. I have examined this aspect of the question here.

In order to get a preliminary idea of the relationship between the penetrating powers of the various visible rays, I began with the following experiment:

1) Niels R. FINSEN: On the use of concentrated chemical light rays in medicine, Copenhagen 1899, p. 29

The rays of a 70 amp lamp were collimated by refraction through the front lens of a FINSEN concentrator. A VIERORDT-Krüss spectroscope was set up in the bundle of rays and first one, then two, three and finally four rabbit ears with natural blood cells were placed in front of its slit.

If only one ear was in front of the slit, all colors of the spectrum were visible in the spectroscope. If two ears were placed in front of it, the blue-violet rays disappeared, while the green, yellow, and red penetrated well. The green rays disappeared as soon as the number of ears in front of the slit was increased to three, and through a quadruple layer I observed only the red part of the spectrum. The latter was also the case when I put a finger in front of the column; but when I held the whole hand in front of it, no visible rays passed through with the concentration of light employed.

Even these investigations indicate that the ability of visible rays to penetrate through animal tissue increases with the wavelength of the rays. However, they prove nothing insofar as we have the absolute quantitative ratio between e.g. B. the red and blue rays, which are emitted by the same light source, neither know nor have any methods of determining it themselves. If we suppose the repetition of the above experiments with a light which contains a significantly greater proportion of blue and significantly less red rays than electric light or sunlight, the result would perhaps be quite different.

The real relationship between the Pene. We only get to know the ability of the different types of radiation to be capable of tration by examining each one individually

at all

Spectral area for yourself and examine how many percentages of the applied - i.e. more or less similar - rays penetrate through one or other animal tissue of the same thickness and then compare the percentage values found for the different types of radiation with each other. I have taken this path in the experiments below.

As a result of the unequally strong effect of the different types of radiation on the same reagent, in order to get measurable values, I had to change the sensitometer for each new spectral section with which I was working, and then it was a question of choosing for each individual type of radiation which would give the clearest expression for the energy.

Now, since the ultra-red rays manifest themselves particularly easily as heat rays and the intensity of the red-yellow rays is most precisely determined by their effect on the retina, since finally the blue-violet rays have, so to speak, a specific effect on silver salts and the ultraviolet rays are so decidedly bactericidal, I chose zur Investigation of the penetration ability of these spectral sections for the ultra-red rays, their effect on a blackened mercury thermometer, the optical effect for the red-yellow rays and for the blue-violet rays the property of blackening silver chloride paper. On the killing effect of ultra-violet rays through animal tissue on Bac. prodigiosus there were already examinations by Dr. HANS JANSEN (see page 37). The fact that I did not use one and the same sensitometer for all types of radiation cannot affect the correctness of my results, as I only examined and compared the percentages which are able to penetrate the tissue in the different spectral regions.

I obtained the individual types of rays mostly in isolation with the help of the filtration method, only with regard to the "outer" ultra-red rays I had to make an exception. – The filters were regularly examined before the experiments in the light used with the help of a VIERORDT-KRÜSS spectroscope.

Try.

I. The Ultra-Red Rays.

The rays of an electric carbon-arc lamp were concentrated by a Finsen (8 cm.) apparatus, from which the water, which otherwise serves to absorb the heat rays, was removed. In the cone of light, an almost saturated solution of iodine in carbon disulphide was placed in an ordinary glass filter with a 1 cm distance between the walls. Such a solution cuts off all rays except the ultra-red ones. As carbon disulphide boils at a fairly low temperature, the filter was sprinkled with a steady stream of cold water, which in such a thin layer absorbed only comparatively little heat radiation. Since, moreover, the vapor of carbon disulfide is highly irritating to the respiratory organs and at the same time is very easily ignited by the arc lamp, I prevented evaporation by covering the surface with a layer of water; its specific gravity is less than that of carbon disulfide, and the two liquids are sharply separated. A little way out of focus I set up a thermometer with a blackened case. By attaching the same in greater or lesser

Distances from the point of concentration of the cone formed by the invisible ultra-red rays I could work with varying temperatures - from 2000 and down with the carbon disulfide filter in place. Having read the temperature, I now placed the ear-lobe of a white rabbit in front of the thermometer and again read the temperature when the mercury column had come to rest. If this temperature is higher than the simultaneous temperature of the rabbit's ear, this must be attributable to the ultra-red rays which have penetrated the tissue. However, since the refraction of the rays in the ear is not regular, but they spread out in all directions after passing through, the temperature found depends to a large extent on the distance between the ear and the thermometer holder, since it will be higher the smaller the distance is. The point was, therefore, to place the ear as close to the thermometer as possible, and yet avoid touching it, as conduction heat, as will be mentioned later

can change the results entirely.

The inherent heat of the rabbit ear, which depends to a large extent on the temperature of the environment, is also of great importance.

The ear used was between 1.5 and 2 mm thick and the hair was carefully clipped on both sides. If I touched the container of a thermometer with this ear -- in a room temperature of 200 (Celsius), the mercury column rose up to 35° (a). At 13° room temperature, the thermometer showed only 30° (b) when touched with the ear, and if one sprinkled one side of the ear with 15 degrees water at the same room temperature, the thermometer on the opposite side read 160 (c). This shower of cold water, which constantly conducts away the heat supplied, proved sufficient to cool the ear so much that the rabbit did not react, even when the ear was held at the focal point of the concentrating apparatus, where a blackened thermometer read over 200°1).

The figures above indicate that the thermometer, if placed in contact with the rabbit's ear, will give approximately its instantaneous intrinsic heat

If I held the thermometer as close as possible to my ear at a room temperature of 13o - but without touching it - the mercury column showed only 19° (d). If there was a one-inch distance between the ear and the thermometer, its temperature rose only 2° above the temperature in the room. In later calculating the results of the experiments we make special use of b and d of these investigations, as a result of which a thermometer in close contact with the rabbit's ear shows 300, and 19" if held as close to it as possible, however without touching the ear and if all other proportions are equal.

After I had changed my experimental setup on various occasions in order to avoid the most important sources of error, I concluded the following experiment, which, when repeated, yielded completely consistent results.

1) FINSEN showed how effective such a cooling of exposed tissue can be by exposing his arm to radiant heat of 220–

-230° If he simultaneously cooled the exposed spots with the help of a pressure glass through which water flowed, he felt no burning (reports from FIXSENS med. Lysinstitut III, p. 24).

suspended.

Messages from Finsen's medical light institute.

IV

8th

October 21, 1902.

Attempt I

49 volts.

The lamp: 60 amps.

The filter: iodine in carbon disulfide.

room temperature 14.

The thermometer shows directly irradiated: 178° to 180°.

behind the inserted

water sprinkled rabbit

ears in the immediate

contact with this 30°: à 319.

behind the ear, this one like that

close as possible, but without

direct touch (approx. 2 mm):

65°

1 cm behind the ear 50°.

directly irradiated, but with water

overwhelmed : 150

The temperature of the water: 140

The room temperature after the experiment: 14°/2°.

The thermometer remained constantly in the same place while the rabbit's ear was brought nearer or farther from it.

In this experiment (as in b above) we have a temperature of 30° when the thermometer touches the ear; but instead of showing 19° (as in d), when it is brought as close as possible to the ear without touching it, it shows 650 here. This difference: 650 - 19° = 46° must, since all the others here too conditions are similar, are ascribed to rays that have passed through the ear. Since the thermometer showed 165° above room temperature when directly irradiated (1790-14), about 28% of the ultra-red rays penetrated through the water-sprinkled rabbit ear.

1

1

57° above

30.9)

The reason I calculated the percentage in the manner described above was only because the thermometer showed 30° in direct contact with the ear in this experiment, just as it did in b. The result gets a little bigger when you

I calculated the percentage as follows in the following experiments: Directly irradiated, the thermometer showed: 1790-140 = 165° above room temperature, 2 mm behind the inserted ear it showed: 65°_14 room temperature. As a result, about 31% are through

51 • 100 Ear penetrated

0.9); but since it is

165, as will be shown later, revolves around minimum values, I consider it right to use the smallest number.

In order to examine whether the percentage of heat rays passing through the rabbit's ear varies with the intensity of the rays applied, in the following experiments I brought a thermometer a little further outside the point of concentration in the invisible cone of rays. November 19, 1902.

attempt II

The lamp: 62 Amp. 47

Volt.

The filter: iodine in carbon disulfide.

The thermometer shows directly irradiated: 45° room

temperature 121/20.

as close as possible behind that

water sprinkled rabbit

ears (without touching it): 230.

Room temperature: 14'/2o.

directly irradiated: 46° room

. temperature: 141.0. The temperature of the water was: 121/2".

99

.

26.6

In this attempt about 27% penetrated

8.5:100

32 of the rays through the water-sprinkled ear - and compared with Experiment I, it turns out that the percentage ratio between the warming effect before and after passing through the rabbit ear is to some extent independent of the intensity of the rays.

When assessing the above test results, one source of error must also be taken into account. As mentioned, I sprinkled the rabbit's ear with a steady stream of cold water, so that the increased warmth of the ear should not affect the temperature of the thermometer. Although the layer of water through which the rays had to pass was of very slight thickness, a certain amount was absorbed; the result found (28%) is therefore to be regarded as a minimum value.

In this series of experiments all the invisible heat rays which are emitted by the electric arc light and which are able to penetrate through the filter used are summed up. Because of the very high temperature in the arc, however, the "inner" ultra-red rays are particularly strongly represented; the number found must therefore essentially be traced back to this and not to the extreme part of the ultra-red spectrum.

A metal which has been heated nearly to redness will emit rays whose maximum intensity corresponds to rays of less refractivity than was the case in the previous experiments, and in order to examine the penetrating power of these "outer" ultra-red rays I used to the following

I) This designation does not mean the very outermost part of the ultra-red spectrum.

SO

Try the radiant heat of an iron stove that is not too hot.

I placed a thick cardboard screen near the stove, covered with tinfoil on the side facing the stove.

Behind the screen I placed two thermometers pointing at the same time - one (A) with a blackened, the other (B) with an unblackened case. Just in front of A a hole was cut in the screen,

that the mercury container was exposed to the radiant heat of the furnace. After reading the temperatures of both thermometers, the rabbit's ear, formerly used, was laid out in front of the hole in the screen, and the temperature read again as soon as the column of mercury had come to rest. The cardboard disk warmed up only slightly during the experiments, and the thermometer protected by it showed the same temperature, no matter whether the mercury container was a little nearer to the screen or a little farther away.

October 30, 1902.

Trial III.

Thermometer A directly irradiated: 45°

B: 19°. irradiated through the rabbit ear: 240 - B 19

° . Distance of the rabbit ear from the mercury container

approx. 6 millimeters.

attempt IV

Thermometer A directly irradiated: 400 B: 180.

irradiated through the rabbit ear: 23°

B18°. Distance of the rabbit ear from the mercury container

approx. 6 millimeters.

November 4, 1902.

Attempt V

Thermometer A directly irradiated: 370 B: 190

irradiated through the rabbit ear: 23°

B: 199 distance of rabbit ear from mercury container

approx. 5 millimeters.

0

Trial VI.

Thermometer A directly irradiated: 400 B: 200.

irradiated through the rabbit ear: 23°

B: 20° distance of rabbit ear from mercury container approx. 7 millimeters.

0

In the 4 experiments, about 19% - 23%, 22% and 15% of the heat rays penetrated through the rabbit ear.

The nature of the sources of error is exactly the same as in the first series of experiments, in that the results are varied with the greater or lesser distance between the rabbit's ear and the mercury container: if the distance is great, the heat rays are scattered too much, and the temperature found is therefore too low. If you make the distance small, the inherent heat of the rabbit ear will play too large a role. The last circumstance in particular can affect the results of the experiments described. One can assume that the irradiated ear had approximately the same temperature as the irradiated thermometer in each experiment - i.e. around 40° (see page 4--5); but a rabbit's ear of this inherent heat, at the given room temperature, will cause a thermometer whose case is placed at a distance of 5-7 millimeters to read several

0

from

degree to rise. The test results are therefore too high and can only be used as maximum values.

In order to find a minimum value, I repeated the experiments with my ears sprinkled with water, just as in the first series of experiments.

I thereby prevented the ear's own heat from affecting the temperature of the blackened thermometer, but at the same time I introduced a new source of error with the opposite effect: absorption in the thin layer of water through which the rays now had to pass. This source of error, which was of minor importance in the first series of experiments, may play a greater role in this one, partly because of the comparatively low intensity of the rays (lack of concentration), partly because the least refractable rays are particularly strongly absorbed by water.

November 4, 1902.

Attempt VII

Thermometer A directly irradiated: 37° B: 189.

by water-sprinkled rabbit

Ear irradiated: 200 B: 189. Distance of the rabbit ear from the mercury container approx. 4 mm.

Temperature of the water: 17!

If you held the thermometer about 4 mm over the rabbit ears and excluded the radiant heat of the oven, the thermometer indicated the room temperature: 18°.

from the

As a result of this experiment, the effect of the outer ultra-red rays is weakened by about 90%, so that about 10% of the rays go through the ear.

In order to be able to work more conveniently and at a lower room temperature, I used a hollow cast-iron cylinder as a jet generator in the following experiments; its diameter was 20 cm, its length 16 cm, and one end of it was closed with an iron plate 1.3 cm thick. I directed a strong jet of flame against the inner side of this plate and blackened the corresponding area on the outer side with pine soot. The whole apparatus was set up in the middle of a fairly large, unheated room, and surrounded by a high cardboard screen, in which there was a circular cut-out corresponding to the blackened spot on the iron plate. The cardboard screen used in the previous experiments with the two thermometers (A and B), the cases of which were both blackened with pine soot, was then placed outside this section. The distance between the thermometer A and the radiation generator was about 7 cm. In the experiments, a thermometer, the blackened case of which was held in contact with the iron plate, showed temperatures of 2500 to 300" but, owing to the thickness of the plate, the oscillations in the surface temperature proceeded with great slowness.

November 13, 1902 at 1 p.m.

Attempt VIII.'

440

99

Thermometer A directly irradiated:

Thermometer B: 121/2. approx. 4 mm behind the water-sprinkled rabbit ears: 170 thermometer B: 131/2".

directly irradiated: 44° — Therm. B: 13o. The temperature of the water: 9'/,.

Experiment IX.

At 2 o'clock.

Thermometer A directly irradiated: 43° thermal

meters B: 121/20

approx. 4 mm behind the water

rarely ears: 180 thermometer B:

141/2?:

directly irradiated: 421/20 thermal

meter B: 140

Temperature of the water: 9'/2o.

Trial X. November 15. Thermometer A directly irradiated: 520 Thermo

meter B: 140

approx. 5 mm behind the water

rarely ears: 161/2° — thermometer B:

14°/2°

directly irradiated: 52° thermal

meter B: 14°/2°:

Water temperature: 10°.

0

Trial XI.

Thermometer A directly irradiated: 53

Thermometer B: 14°. behind and in direct contact with the inserted, sprinkled rabbit ears: 130 - thermometer B: 14°.

Experiment XI shows that the intrinsic heat of the rabbit ear sprinkled with water can hardly have had any effect on the temperature of thermometer A in Experiments VIII, IX and X.

0

In the three experiments (VIII, IX and X) penetrate resp. about 11%, 12% and 5% of the applied rays through the ear. Due to the nature of the source of error, these

. Percentages are to be considered as minimum values, and the result of the whole series of experiments is that between 5% and 23% of the outer ultra-red rays penetrate the rabbit ear.

II. The red-yellow rays.

I determined the percent penetrability of these rays by measuring how much optical clarity was degraded when the rays passed through a rabbit's ear. The institute's physicist, Mr. cand. mag. ABSALON LARSEN, and in the measurements ABSALON LARSENS photometer) was used, which is being constructed for the purpose of similar investigations. It consists of two incandescent lamps slidably mounted on a long graduated rod, in the center of which is a Lummer-Brodhun double prism, which can be observed through a magnifying glass. The prism is protected against undesired effects of light with a small sheet metal sleeve, blackened inside and out, in which there are two round openings for the passage of the examined light. In these experiments the two openings were covered with a layer of thin white paper, so that the light could be distributed from both sides. It was worked in the dark room, so that the image projected in the prism could be ascribed exclusively to the light from the incandescent lamps. These burned at 110 volts and were made of red glass. At the spectro

1) Notifications from Finsens med. Light Institute 1899, II, p. 108, figure 3.

scopic examination of the same it was found that visible rays other than the red-yellow ones also passed through, but so greatly weakened that their importance in the method of investigation employed becomes minimal. In a second series of experiments, the red incandescent lamps were replaced by ordinary uncolored ones.

The rabbit's ear was attached to the outside of the piece of paper in front of one side of the prism and the corresponding lamp was pushed forward until the figures in the double prism changed. From the relationship between the distances between the lamps and the prism, one could then calculate the percentage by which the optical light intensity was weakened.

The result of repeated investigations was that about 22% of the red-yellow rays passed through the rabbit's ear, while only 16% of the white light from an ordinary incandescent lamp passed through the ear. It hardly needs to be emphasized that the latter value does not apply to "white" light in general, since its quality varies with the temperature of the various light generators, among other things.

approx.

III. The blue-violet rays.

The rays of a 70 amp arc lamp were concentrated by an ordinary 8 cm apparatus. This was filled with water, so that most of the heat rays were retained. In addition, the light was filtered through a 3% ammoniacal solution of copper vitriol, so that I worked only with blue-violet rays and the ultraviolet rays that were the same. (A few green rays also passed through the filter.) A definite point in the cone of rays outside the focal point was marked with the aid of a stand, and all experiments were carried out at this distance.

As a sensitometer I used ordinary pieces of silver chloride paper which were exposed in a series for different times, either 1) directly or 2) immediately behind the blood-filled rabbit ear. The times were noted on the back of the pieces of paper, which I compared after exposure to find the approximately equal degree of blackening of the two exposure rows. The comparison was made somewhat more difficult by the fact that the silver chloride paper exposed through the ear was not evenly blackened because of the greater absorption in the larger blood vessels.

I found the ratio 1:80 between the times required in the two sets of experiments to achieve the same blackening of silver chloride paper. With two rabbit ears put together, I got no blackening of the paper at all, even after 20 minutes of exposure. Blackening did not occur until the ear was emptied of blood by compression.

So the ability of the blue-violet rays to act on silver chloride paper is reduced by about 99% when filtered through a blood-filled rabbit ear, in other words, just a little over 1% of the rays penetrate through the ear.

IV. The ultraviolet rays.

If one considers the above results with the investigations into the depth effect of light from a bactericidal point of view, which Dr. HANS JANSEN at the same time in published in this issue, you will get a picture of the course of the penetration courses through the whole spectrum. dr Jansen's experiment shows that the external ultraviolet rays (the part that is absorbed by the glass) in the concentration used are not able to have a bactericidal effect through a skin layer which is thicker than 0.8 mm. This is also excised dead skin, i.e. bloodless tissue.

The inner ultraviolet rays penetrate significantly better. dr JANSEN used these to kill bacteria at a depth of 1.5 mm. On the other hand, he never succeeded in killing bacteria through a skin two millimeters thick, and as the bactericidal power of the rays mentioned is extremely great when directed against the bacterial cultures, it may be assumed that they are almost entirely absorbed in the tissue. The probability therefore speaks for the fact that, even in significantly higher concentrations, they are not able to penetrate through a blood-filled rabbit ear 2 mm thick. As we have seen, about 1% of the blue-violet Sirahl and about 22% of the red-yellow Sirahl succeeded in penetrating through one of these; this was also the case for at least 28% of the inner ultra-red rays, while the percentage value for the outer ultra-red rays which passed through a rabbit's ear was between 5 and 23%, The result of my research is the following:

The curve of the penetration ability of the different types of radiation through a blood-filled rabbit ear (and thus, by all appearances, through most animal tissues) rises from it

0

extreme ultraviolet, where the ability to penetrate is extraordinarily small, through the inner ultraviolet and the colored part of the spectrum, and the gradient continues somewhat in the ultra-red part, where the maximum for the ability of the rays to penetrate is to be sought. In the outer part of the ultra-red, the curve falls again.

The relations between the penetrability of the different types of radiation can be expressed by the following approximate numbers.

The numbers are to be interpreted in such a way that the red-yellow rays are able to penetrate about 22 times better through an animal tissue than the blue-violet ones - the inner ultra-red ones more than 28 times as well and SW; only the relative proportion among them matters, while taken individually they have no value as absolute numbers.

In conclusion, I repeat what I have emphasized before, that the use of different sensitometers in examining the different spectral regions in this connection, where only use has been made of the percentage, is not only permissible, but also affords greater certainty of a reliable result , than the use of a common sensitometer, which would give only minimal and hardly measurable deflections with regard to some radiation qualities. On the other hand, it is clear to me that these studies are only to be regarded as indicative; the sources of error in each of the individual attempts are so great and so difficult to estimate that the figure found gives only a rough indication of the course of the penetration curve.

opposite the light.

Of

Hans Jansen.

While it has been sufficiently demonstrated that the bacterial spores are considerably more resistant than the vegetative forms to heat, desiccation, and the action of chemical agents, there are as yet no valid studies of their resistance to light.

Most investigators who have dealt with the bactericidal power of light have carried out their investigations with nonporous forms; some like DOWNEs and BLUNT, Tizzoni and CATANI, WARD, DIEUDONSÉ and KEDZIOR probably needed spores simultaneously or exclusively, but they did not enter into a comparison between these and the vegetative forms.

On the other hand, the following investigators, whose main results will be given shortly, have dealt with this question.

ARLOING 1-4) found that anthrax bacilli were significantly more resistant than anthrax spores. A Pasteur flask with chicken broth to which a drop of sporulated culture was added

1) ARLOING, influence of soleil on the vegetation of the spores of Bac. anthracis. Compt. ren. de l'académie des sciences, 1885, T. CI, p. 511

2) ARLOING, the influence of soleil on the vegetation, the vegetation and the virulence of the cultures of Bac. anthracis. Compt. ren. de l'académie des sciences, 1885, T. CI, p. 535.

3) ARLOING, Influence de la lumière blanche et de ses rays consti

on the development and properties of Bac, anthracis. Arch. de physiologie norm. et pathol., 3rd series, 1886, T. VII.

4) ARLOING, Les spores du Bac. Anthracis is actually realized by the lumière solaire. Compt. ren. de l'acad. sciences, 1887, Part VII.

tuants

was from

sterilized by the sun in two hours (July; 350--39), while a 24-48 hour old culture of bacilli under similar conditions was killed after 25-30 hours. Since NoCARD 1) and STRAUS?) made the justifiable objection that the spores might have germinated during exposure to light, he repeated the experiments under conditions in which germination was impossible (partly from cold, partly from temperatures of 52); but he always found a considerably shorter killing time for spores. Only when he illuminated the spores in distilled water, as suggested by STRAUS, did the killing time increase sharply, up to 16----30 hours, so that it almost bordered on that of the bacilli.

This was clarified by Roux's work. In the same it was shown that when exposed to the sun for 3-+ hours, bouillon is subjected to such chemical changes that germination of the spores is impossible. If ARLOING had sown the exposed spores in the broth in an unexposed nutrient substrate, like he did

If he had to do it in distilled water during the experiments, he would certainly have gotten a different result. Roux himself made some experiments, placing a drop of sporulated culture of anthrax in the bottom of a test-tube, which, sealed, was left exposed in the sun; after the exposure he provided the glasses with unexposed broth. He stated as.

SO

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1) NOCARI), Recueil de médecine vétérinaire, Sept. 17, 1885. Ref. by ARLOING,

2) STRAUS, Compt. ren. de la soc. de biologie, 1886. Ref. by ARLOING.

3) Roux, De l'action de la lumière et de l'air sur les spores de la bacteriadie du charbon. ann. de l'inst. Pasteur, 1887, I

then only sterilization after 29-54 hours of exposure, i.e. times which still exceed ARLONG’s figures for bacilli. However, he did not determine it himself, as he considered it proven that the spores had to be more resistant. He also pointed out that DUCLAUX 1-") killed cocci in 2-3 days under the same conditions (sun, dried state), but only after 1-2 months in the case of a spore-containing bacillus (Thirotrix scaber).

GAILLARD 3) did not come to any more precise results in his thesis on the influence of light on microorganisms, since he confines himself to almost slavishly repeating all previous attempts.

In PANSINIS +) investigations made in Naples, dried anthrax spores proved about eight times as resistant to sunlight as bacilli culture in hanging drops.

RASPE5) found that a 24 hour old culture of bacilli (anthrax) was significantly more resistant than the spores, whether exposed to broth or water.

MOMONT"), on the other hand, showed that cultures of anthrax bacilli were killed by the sun in 2-5/2 hours

I) DUCLAUX, Influence of the lumière du soleil sur the vitality of the germes de microbes.

Compt. ren. de l'acad. des sciences, 1885 TC 2) DUCLAUX, Influence de la lumière du soleil sur la vitalité des micrococcus. Compt. ren. de l'acad. des sciences, 1885, T. CI.

3) GAILLARD, De l'influence de la lumière sur les microorganismes. Thesis. Lyons 1888.

4) PANSINI, Dell'azione della luce solare sui microorganisms. boll i.e. society di naturalisti in Napoli 1890 (ref. in LEREDDE et PAUTRIER, Phototherapie et Photobiologie, Paris 1903.

5) RASPE, Ceber the influence of sunlight on microbes. Inaug. Dissert., Rostock 1901.

6) MOMONT, Action de la dessication, de l'air et de le lumèrei sur la bacteriadie charboneuse filamenteuse. Ann, de l'inst. pasteur. 1902, VI. Messages from Finsen's medical light institute.

while spores suspended in water required 44 hours and 100 hours when dried

were.

The last work on this subject dates from 1895 by KRUSE"), who also made some experiments with anthrax spores during his investigations into the hygienic significance of light. These are sun experiments carried out in Naples in June. A hanging drop of a spore emulsion in distilled water was killed in two hours. If he allowed the drop to dry first, 4-5 hours were necessary for killing. He compared this with the typhoid bacilli, in which the drop after 1-11% hour, in the dry state after I

, 1/2-1 hour kill was achieved. As a result he stated: "When dry, the spores resist the light far better than the vegetative forms; in liquids a similar difference is not noticeable.«

All these investigations mentioned have been made in sunlight, the variability of which makes it impossible to compare the results obtained at different times or in different places, and the warmth of the sunlight, combined with the long duration of the experiments, involves the danger that the spores germinate during exposure.

In ARLOING's first experiments, with GAILLARD, RASPE and KRUSE, there is a probability that germination has occurred not only in cases where the spores were exposed in broth, but possibly also in those where they were exposed to distilled water, because they were not through off

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1) KRUSE, On the hygienic importance of light. f. Hygiene, 1895, vol. XIX.

washing were freed from the nutrient substrate clinging to them.

Roux, on the other hand, avoided germination by illuminating the spores in the broth in which they were grown.

Incidentally, the same can be achieved by experiments with dried spores (DUCLAUX, PANSINI, MOMONT, KRUSE), but they are then to be compared with dried vegetative forms, as was also done by DUCLAUX, MOMONT and Kruse. It must be remembered, however, that this process is an effect of sunlight + desiccation, and since desiccation, as Duclaux and Momont themselves have proved, is particularly harmful to the vegetative forms and much less so to the spores, this may be the main reason for the differences be in the results.

That DUCLAUX and KRUSE compared spores of a bacterium with other sporeless bacteria can hardly be regarded as correct.

The toxic effect of the broth altered by isolation is generally taken into account by overseeding (according to Roux's instructions).

Own attempts.

From the above it will be seen that comparative studies on the resistance of bacterial spores and vegetative forms to light are concerned with 1) preventing germination of the spores during the experiments, 2) exposure to light in the surrounding medium to avoid the resulting toxins and 3.) to use spores and bacilli of the same bacterium and to expose them separately under completely the same conditions. When using strong electric light, as is available to us here in the Light Institute, and when applying the rational lighting methods worked out here in the institute, the difficulties relating to points 1 and 2 disappear almost entirely, since the experiments last an extremely short time. The longest exposure times were: in unconcentrated light 21 minutes, in concentrated light 5 minutes (only in individual special experiments through glass 30 minutes). Since at the same time the temperature did not exceed 20°, it will be understood that the conditions for germination were not favorable. With regard to the formation of toxic substances in the culture medium, it must be said that minimal amounts of these can possibly arise even after short-term exposure to light; but after some as yet unpublished attempts by Dr. BIE involves significant times and strong light before the crowd grows large enough to have any significance. However, in order to be completely sure that this source of error was excluded in my experiments, I made the following control experiments: I partly exposed the broth to light for a longer time than was usually used in my main experiments and then seeded it with spores; there was growth as rapid and as extensive as in the control. I sometimes inoculated mice with agar seeded with spores but light sterilized: these did not die, while other mice inoculated with unexposed seeded agar died after 24 hours. From this it could be concluded that in my experiments absolutely no effect of changed food substrates could be felt.

The experiments are with Bac. anthracis running; only to a small extent (see page 156) is Bac. subtly used. Two different cultures of anthrax were used, one of unknown origin, which was found in the laboratory, and one freshly bred from a horse suffering from anthrax, which Mr. Assistant BAHR of the Agricultural College's Experimental Laboratory was kind enough to procure for me.

Spores were taken from 2-day to 3-month-old cultures on agar slants and made into uniform emulsion by trituration in mortars with distilled water or broth and filtration through cotton filters. The emulsion was diluted in such a way that it became as uniformly weak as possible, and it was examined under the microscope before use. The spore content of the culture can vary so extraordinarily that it is necessary to examine each time whether it contains many or few spores.

According to Roux, in order to protect oneself against the remains of bacilli and threads which may still be present in such agar cultures, the emulsion could be heated to a temperature which kills the bacilli but not the spores. This has happened in some of the experiments, but they are not entirely pure as a result; Comparing the effects of heat with subsequent exposure, on the one hand, and exposure alone, on the other, it will be seen, as shown below, that spores first heated to 70° for 5 min. behave somewhat less resistant to the light than unheated ones.

I obtained the vegetative forms of the same bacteria using a fresh broth culture after frequent inoculations (twice a day for 2-3 days). As for anthrax, sporulation (at 36) according to WEIL') occurs only after 15-16 hours. I could therefore safely use 4--15 hour old cultures, even 18 and 24 hour old cultures could be used, as they proved to contain very few spores. Anthrax bacilli can also be obtained without any spores from the blood of an anthrax-infected animal. Some experiments (4) made with the same material (spleen of an infected mouse rubbed in distilled water and filtered) gave exactly the same result as bacilli from the broth.

archive, for hygiene,

1) WEIL, On the biology of anthrax bacilli. 1899, Vol. XXXV.

The experimental arrangement will show that it was possible to expose these spores and bacilli under completely similar conditions.

This has been different according to the conditions to be examined; the experiments fall, as far as the arrangement is concerned, into two main groups, according to whether they are carried out with unconcentrated or concentrated electric arc light.

Experimental arrangement with unconcentrated,

electric arc light. Here I used the apparatus indicated by BAXG 1) for “gradual exposure”.

The bacteria are spread by means of this apparatus on an agar surface, and during exposure they lie in front of the light rays in such a way that only air, a layer of distilled water 2 cm thick, and a couple of quartz plates pass before they reach the bacteria; the area was exposed in segments at increasing times.

After staying in thermostats after exposure is found according to the duration of the exposure time

I) BANG, Liver the effects of light on microbes. II. An improved method of investigation. Mit. FINSENS med. Lys Institute, 1903, III.

out

more or less abundant growth. The time during which the first absolutely sterile segment was exposed is the "absolute kill time"; "the relative killing time" (see BANG) is the exposure time for the first substantially sterile segment in which single, scattered, easy to count colonies are still found. Incidentally, I have to refer to the previously mentioned work by BANG for the exact arrangement; I only want to discuss here the special conditions for my experiments.

The lamp was an ordinary carbon arc lamp burning at 30 amps and 48-50 volts. The diameter of the upper char was 24 mm, that of the lower char 18 mm, the distance between the tip of the positive char and the culture was 60 cm; in some experiments only 42.4 cm, at which distance the light intensity is twice as great, so that the exposure times can be halved here, which was an advantage in the spore experiments. The temperature of the water surrounding the cultures was 20! The Petri dish, in which the "exposure dish" stood after exposure in the thermostat (369), was not only provided with several layers of plenty of moist filter paper, but there was also a rubber ring along the gap between the upper and lower parts to To prevent evaporation, as a lot of moisture is required for the spores to grow out.

In spore experiments, these were ground in distilled water and 4-5 loops of emulsion were transferred to the exposure dish; in bacilli experiments, the loops were taken directly from the young broth culture; otherwise all experiments were similar.

To find the kill time for a culture, a number of exposures were taken; e.g. B. a dish was exposed in segments for 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24 min. If now the segment which had been exposed for 20 min proved sterile, while in which there was growth exposed for 18 min, 20 min was taken as the absolute kill time. Nevertheless, it was possible that this was between 18 and 20 minutes, e.g. B. at 19 min. and that this would have become apparent if the difference between the exposure times had been shortened. I will continue to call this difference the "interval". This value must always be added to the killing time numbers, since only then does one get to know the degree of accuracy with which they are determined. As a rule, the interval in experiments with unconcentrated light was 1-1/1 of the killing time (try 4 min for spores, try 1 min for bacilli).

The experimental arrangement with concentrated, electric light.

The lamp, the same as that previously mentioned, burned in these experiments at 25 amps, 48-50 volts. The light was concentrated using a smaller 7 cm Finsen concentrator. Diameter front line and in a 20 cm. large distances from the arc?).

In the cone of light, a little behind the focal point, at the point where the light spot has a diameter of 1.6 cm. the culture was attached as a hanging drop. The thickness of the drop was usually 0.3 mm, at most 0.4 mm.

1) It is to be noted here that the light intensity used in these experiments is considerably less than that used in the treatment of lupus. Here the current is 60-70 amps, the front lens only at a distance of about 12 cm from the bow and often 8 cm in diameter. The level of light used in the experiments gave appropriate and easily measurable times to kill. At the light intensity used for treatment, the bacteria are killed so quickly (about 1 sec) that it is impractical to test.

In some of the experiments an ordinary "moist chamber" was used, which was formed from a hollow-ground slide; only here the cover "glass" was not made of glass but of quartz. During the test, cold water flowed over the face of the cover quartz. That the cooling was sufficient was shown, among other things, by the fact that gelatine (melting point 24°) did not melt under these circumstances and a blackened thermometer, placed in the same place and sprinkled over, showed only 18°.

Instead of a humid chamber, I often used small open dishes, the sides of which formed a brass ring and the bottom a quartz plate 4 cm in diameter. They were placed upside down in the cone of light over which water streamed; the drop of culture was deposited on the inner (facing down) side. After the experiment, these dishes had to be placed in Petri dishes with moist filter paper. The only flaw with these dishes was that they were not as good for microscopy as the wet chambers.

The spores were emulsified in either broth or distilled water; in the latter case a drop of liquid agar was added after the experiment. This was also done in cases where dried bacteria were used.

The experiments with concentrated light proceeded in such a way that, in order to find the killing time for a certain spore emulsion or culture, I illuminated a number of moist chambers (or dishes) at different periods of time, namely at times which I

had to consider killing necessary. I searched

to give an example, the kill time for a spore

emulsion and had found in the orienting example,

that the same was less than 5 minutes, I prepared seven wet ones

Chambers and exposed from these six in the following time

vacate: 5, 3, 2, 1,, I, 3/4 mins, while the seventh as

Control remained unexposed. I put all seven bowls

then in the thermostat. revealed in the next few days

the shells the following growth ratio:

exposed for 5 minutes

no growth,

2

.

Three minutes was therefore the absolute time of killing for the spores in question, or quite simply the time of killing, since in this arrangement no account is taken of a relative one.

But this determination is approximate in the same way as described on p. 136, and the accuracy is evident from the size of the interval. In experiments in concentrated light, this was as a rule 1/3-1/4 of the exposure time.

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The investigations had the following aim:

I. To determine whether the spores of Bac. anthracis are more or less resistant to the light when moist than the bacilli.

II. To find at what point in germination the greater resistance of the spores is lost.

III. To determine whether dry spores are more or less resistant to the light than moist ones.

IV. To investigate whether the spores, like the vegetative forms, are preferentially killed by the ultraviolet rays. As an appendix.

V. The resistance conditions for the spores of Bac. to be determined subtly.

1. Investigations as to whether the spores of Bac. anthracis more or less resistant to when wet

above the light are than the germs.

The investigations are carried out partly with unconcentrated, partly with concentrated light.

In experiments with unconcentrated light, spores spread out on an agar plate and exposed to light were compared with bacilli attached in the same way (BANGS apparatus, see above).

Almost all spore trials and some bacilli trials are in a 16.75 inch. large distances from the arc (see p. 135). However, for comparison, the kill times found in this way are reduced by multiplication by 2 to apply to a 60 cm wide distance. Such a reduction is fully permissible as a result of numerous tests. In the tables, this ratio is indicated with the designation: reduced.

The sign > (greater than) in front of a time specification is intended to indicate that it did not result in killing, but was the longest duration of the experiment.

The results are as follows: Table I. The kills found for anthrax spores

times at 30 amps, approx. 50 volts, 60 cm from the

Arcs classified by culture age. The cultures in No. 8 and 9 are from stock culture II, the others

from stem culture I

3 Oct. 24, 1901 12 days 4 Oct. 30, 1901 18 days 5:13. Nov. 1901 I Mon. 6

I Mon. 7 Feb. 22, 1902 1'/, Mon. 8 Sept. 8, 1902 1

2

20 reduced. emulsion under

warms 20 reduced. emulsion under

warms 12 | The first orienting

attempts 20

5 and 6 same culture 16 18 reduced 20 reduced. emulsion under

warms 28 reduced 26 reduced 20 reduced 18 reduced. The Emulsion

(prepared with distilled water) had stood in the thermostat (37) for 4 hours before use

20.6

Average (No. 3 and 4) not

included; No. 7 > 28

28 set

The absolute killing time of the spores was therefore never less than 20 minutes, an average of 27 minutes. There seemed to be no major difference worth mentioning between the young and old spores, perhaps the old ones were a bit more resistant.

Table 2. The kills found for anthrax bacilli

times at 30 amps, approx. 60 volts, 60 cm from the

Arcs classified by culture age.

All cultures are derived from parent culture I.

The interval in these experiments was consistently 1 minute.

From this table one can see:

1. The absolute kill time for the anthrax bacilli averaged 8½ min; if only the absolutely spore-free, young cultures or "blood bacilli" were taken into account, it was 7 minutes. 16 10 min. was certainly due to the fact that the emulsion was very rich in blood.

2. Bacilli 12-24 hours old were somewhat more difficult to kill than the young bacilli or the bacilli from the blood. However, this difference did not appear to be due to increased turbidity as it did not disappear upon dilution. In particular, the absolute killing time increased with age, a reflection of the fact that more resistant individuals are gradually emerging in the cultures, possibly spores, possibly only bacilli with sporogenic grains, but the largest number consists of the less resistant simple rods.

Incidentally, these proportions are in good agreement with (was Bang?) the importance of age for Bac. prodigiosus found.

Even older broth cultures, one week old, undoubtedly contained spores, but in such relatively small quantities that only the absolute killing time rose to "spore time", while the relative time remained approximately at "bacilli time", as can be seen from the following two experiments can see:

1) S. BANG: The effects of light on microorganisms. I. Variations in the Hardiness of the Bac. prodigiosus according to the age and temperature of the culture. Communication from FINSENS med. Light Institute II, 1901.

Comparing Tab. I with Tab. 2 shows that the spores of Bac. anthracis are under these conditions 3-4 times as resistant to the light as the corresponding vegetative forms.

Experiments in concentrated light with hanging drops gave a very similar result. Most of these attempts have been made for quite different purposes (see under II, III and IV); we only want to collect the killing times found for spores and bacilli in the broth drop. Here we will see at the same time the importance of warming. In some of the experiments the spore emulsion was heated to 70° in 5 minutes before use, as before, but as it turned out that the resistance to the light was thereby considerably reduced, this was omitted in all later experiments . Tab. 4. The for anthrax spores at concentrated

Bogenlichte (see p. 136) found killing times, ordered by the age of the culture.

All cultures are from stock culture II. The exposure times for the individual experimental series were 180 (or 150),

120, 90, 60, 45 and 30 sec.

The very large fluctuations in these experiments arise partly from their being made at different times for different purposes, partly from the greatly varying spore content of the cultures; the latter only became clear to me during the investigations, and I used only those emulsions which contained a large quantity of well-developed spores.

There is no doubt that the resistance is subjected to a change by heating, and in fact such that the heated spores die more quickly, namely experiment no. 3 and 8 look convincing because the same sporulation before and after heating was used here.

Tab. 5. The anthrax bacilli at conc

according to the age of the cultures.

All cultures are from stock culture II. The exposure times for the individual test series were 90, 60, 45, 30

20 and 10 seconds (except in No. 3).

Comparing the mean times for spores and bacilli, it can be seen that the heated spores were scarcely three times and the unwarmed scarcely four times as resistant as the bacilli, i.e. the same as with unconcentrated light. If one excludes in the meantime - which is actually the most correct - the isolated particularly low or particularly high killing times and only takes into account the unheated spores, it turns out that the difference is somewhat larger, in that the absolute killing time for unheated spores is often 21.00 --3 min. and for bacilli /. min. was, that is, a 5-6 times greater resistance of the unheated spores than of the bacilli.

II. Investigations at which point in time of germination the

specific resistance of the spores is lost.

If one prepared two BANG's exposure dishes with spore emulsion and exposed one immediately, the other only after staying in the thermostat at 36° for 2-3 hours, the result was significantly different.

Tab. 6. The killing times (in min.) for spores before and

after dwelling in thermostat at 360 Unfocused light: 30 amps, 50 volts, 60 cm from arc.

Cultures are from stock culture I.

The fact that the killing time did not in all cases reach that of the bacilli (approx. 7 minutes) and in particular not the absolute was probably a consequence of the fact that not all spores began to germinate at the same speed, so that at the moment of exposure there were still individual spores left. On the whole, the germination conditions were less good on these exposure trays.

A more precise determination of the stage of germination at which the transition takes place can be made better and easier by experiments with hanging drops, in which case the illuminated spores can be examined at the same time.

2

2

From a number of moist chambers or dishes (see above) with spore emulsion in broth I exposed a part, e.g. B. five, immediately in periods when I suspected "spore time" (3 or 21, 2, 1, 1 and 3 min.), the others I put in the thermostat at 360. After 1. hour, 34 Hour, etc., one chamber was taken out and exposed for a period of time apparently sufficient to kill bacilli, but too short to kill spores (say, 3 min.). After 2-3 hours I exposed the remaining ones in periods bordering on the bug period (90, 60, +5, 30 and 20 sec). In some experiments (Tab. 7, No. 7, 8, 9 and 10), however, I also carried out a "series exposure after a short dwell",

with a smaller decrease in the time to kill being more evident.

The killing time for spores before and after staying in the thermostat at 36o. Concentrated Light (see p. 136).

Table 7.

All cultures are from stock culture II.

The exposure times as just described.

The times marked with x are not the result of an exposure series, as is usually the case, but individual exposure times (see above). In the meantime, the same have led to killing where there is no > ahead.

Table 7.

X45

x 45

x45

x 45

x 45

x 45

30

Emulsion heated

> 30 30 30

4

12 Sep 02

do.

90

x 45

x 45

x 45

x 45

Kill time in seconds for spores

illuminated after dwelling at 36° in

Special Ver

holdings

1st St.

'/, St.

3/, St.

Is.

1'/. st

1'/, st

1°/. st

2-3 hours

x 30

do.

30> 45

do.

do.

do.

do.

do.

1

2

The table shows a constant decrease in the killing time after "2 hours' residence in the thermostat, now and then as early as 1. hour, and proves that after 2-3 hours' residence there was a complete or almost complete transition to the "bacilli time".

The microscopy carried out at various stages revealed the following:

After 1/4--1/2 hour no change was evident.

After 1 hour, as a rule, the strong refraction of light so peculiar to the spores was on the point of disappearing, so that it was difficult to observe them.

After 2-3 hours one had a pure or almost pure bacilli culture.

The spores therefore lose part of their specific resistance as soon as they start to germinate, at a time when no clear change can be seen.

III. Investigations as to whether the spores, when dry, are more or less resistant to the light

are than in the humid.

As mentioned above, some of the earlier investigators (namely MOMONT and KRUSE) pointed out that the dry spores were more resistant to the light than those suspended in water or broth. I absolutely did not find this.

When a drop of spore emulsion in broth was exposed to concentrated light, the time of killing was, as we have seen, 2½ to 3 minutes; if I let the drop dry and exposed it to light under otherwise exactly the same conditions, I found it to be average

3

1

2

A killing time of only 1 min. and when drying up lasted a few hours even only 3/4-1/2 min. (see Tab. 8).

The reason for this quite significant decrease must now be ascribed to the desiccation as such, as a harmful factor, or to the changed optical conditions.

In order to investigate whether drying in and of itself could have any influence, I made some experiments with drying after exposure (see Table 8). It now turned out that if a number of drops (water or broth) with spores were exposed to light for the usual time (3, 2, 1 1/2, 1 and 3/4 min.) and then left to dry for 2-3 hours, whereupon If some liquid nutrient agar was added to the same, the growth developed worse than in a series of experiments made from the same emulsion, but without subsequent drying. It also happened that the killing time became a little smaller. After drying for a very short time, at most 4 hours, no difference was evident.

So if I have found a significant decrease in kill time with spores dried for a short time, this must be attributed to other circumstances. On the other hand, the further decrease with prolonged drying is certainly due to the harmful effects of the same.

The optical conditions were extraordinarily different; in one case the spores lay surrounded by broth, and perhaps many in a row, in the other they lay quite free and in a layer on the back of the quartz. Now, as is known, at

, bouillon the absorption of ultraviolet rays is extremely important. In some attempts by

Bang 1) it was found that a 5 mm thick layer of light colored veal bouillon before culture increased the killing time by ordinary carbon arc light by about 15 times. As mentioned, the thickness of my drops was about 0.3 mm, at most 0.4 mm; the spores lying at the back of the drop will be quite well protected in this way. In order to determine directly the meaning of the drop, I made some experiments with Staphylococcus pyog. aur. This tolerates drying out quite well and does not have the light refraction peculiar to spores, which could possibly play a different role in the dry and in the moist state. When determining the kill time for Staph. pyog. aur. partly in the bouillon drop and partly after drying for a short time, it turned out that this too was killed three times as fast in the dried state as in the bouillon drop. This only seemed to be due to the more favorable optical conditions. In all probability the decrease found in spore trials is due to the same cause.

It now made sense to use distilled water for the emulsion instead of broth. This also resulted in a somewhat shorter killing time, but not as short as for the dried droplets, which suggests that the position of the spores in the droplet shape also plays a role.

All results of these tests are collected in Table 8.

For comparison with the killing time found for spores in the desiccated state, min., it might be of interest to find the killing time for bacilli under the same circumstances. Referring to that the Ein9 30-Dec-02 1/2

1) I.c. (Mitt. III), pag. 1 12.

Table 8. Killing time for spores, exposed to light: 1) in the droplet, 2) dried up, 3) in the droplet and then dried up. — Focused. light (see p. 136).

All cultures are from parent culture II. The exposure times were: 180, 120, 90, 60, 45, 30, 20, 10 seconds. The times in a row are from experiments performed with the same emulsion.

Emulsion heated. Emulsion heated. *) The row shows: no growth (0) at 3 min.,

weak growth, at 2 and 11/, min., o at

one min, weak growth the following. **) The row shows: o at 3 min., black. growth at

2, o at i', u. 1 min., black. growth in the following.

drying acts on the bacilli fairly easily, it must be as short as possible. In three experiments with bacilli cultures six hours old, in a slightly dried state, they were killed in 1/3, 1/2 and 1/3 minutes. The ratio of resistance for dry spores to dry bacilli is therefore about 3:1.

The result of these investigations is therefore: that the dried spores of Bac. anthracis are in any case no more resistant than the moist ones and are undoubtedly less resistant to long-term drying out.

*

IV. Investigations whether the spores as well as the vegetative forms preferentially from the ultraviolet

rays are killed. Compared to the sporeless forms of bacteria, the outer ultraviolet rays with a wavelength shorter than 300 uu have proved to be by far the most effective (Finsen, as well as investigations by Bang and BiE, which have not yet been published). Corresponding investigations for spores have not yet been carried out.

It would now be possible to attribute the greater resistance of the spores to less exposure to ultraviolet rays. As can be seen on page 106, DREYER found with regard to the amoebic cysts that their greater resistance to light is due to the fact that they are not so sensitive to ultraviolet light as are the amoebic forms. It would therefore be of interest to investigate whether the spores are similar.

mm

The way in which one can examine whether an organism is particularly susceptible to the ultraviolet rays or not consists e.g. B. that one uses the absorption of the glass.

A 1 thick glass plate will usually cut off all rays with a wavelength below about 300 uu. If, by switching on such a glass plate on the path of the rays to the culture, a significant increase in the killing time is achieved, this means that the culture in question is very sensitive to ultraviolet rays. Conversely, if the kill time remains the same whether the glass is on or not, one can conclude that these rays play no role in killing the organism in question.

I found the following ratios for spores and bacilli (Table 9).

It will be seen that the ratio between "quartz time" and "glass time" was 1:7 and 1:10 for spores in broth drops and 1:20 without broth, while for bacilli in broth drops it was 1:5, 1:6 or 1: 16 These results show that the ultraviolet rays act relatively as much on bacterial spores as on bacilli. It might even appear as if spores were somewhat more sensitive to ultraviolet rays than bacilli, in any case when dry. Probably this is just a coincidence. A few experiments which I carried out with Bang's lamp, which, because of its great abundance of ultraviolet rays, was intended to bring out the relationship even more clearly, yielded nothing of the sort.

*

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Table 9. The killing times for spores and bacilli, depending on the glass or

Quartz in front of the cultures. Concentrated Light (see p. 136).

All cultures are from stock culture II.

The spores were not heated.

Exposure times were for spores behind quartz in each experiment: 3, 2, 19/2, 1, 3/4 min; behind glass: 30, 20, 15, 7 min; for Bac. behind quartz: 14, min, 60, 45, 30, 20, 10 sec; behind glass: 8, 5, 3, 2, 1"},, I,

minutes

3

*) These figures are hardly entirely correct, since the Bac suffer slightly from drying out with these longer illuminations. V. Experiments with Bac. subtle.

I

These experiments aimed only at investigating whether the spores of this bacillus possessed a resistance to light similar to that of anthrax.

They are made in concentrated light, but neither the intensity nor the concentration was the same as that mentioned above. The lamp burned at 30 amps, 48-50 volts. The front lens of the concentrating apparatus consisted of two lenses, which together had a focal length of 11/2 cm, which is why the apparatus was placed at this distance from the bow.

Spores were taken from cultures on slant agar. In all experiments they were heated to 1000 for 2 min.

The small rock-crystal bowls previously described were used; but the cultures have been ad mod. BUCHNER densely distributed in nutrient agar

distributed in nutrient agar. The bowls were placed in the cone of light, as usual, with the quartz bottom up and with water trickling over them. The spot of light hit only the center of the shells, so the whole periphery was the control. After staying in the thermostat for 24 hours, the results could be read. Depending on the exposure time, a more or less bright spot surrounded by thick bacterial growth was seen in each dish. The times given in the table below are "relative killing times", the times required to produce a substantially sterile patch with only single colonies to be counted.

Table 10. Killing times for spores and bacilli of des

Bac. subtle. Concentrated light (see above).

The exposure times for spores were: 50, 45, 40, 35, 30, 25, 20

sec, for Baz, 20, 15, 10, 5, 3 sec

From this it is sufficiently clear that the spores of Bac. subtilis are considerably more resistant to the light than the corresponding vegetative forms.

(Approximately 7 times more resistant).

communications from the literature.

HE SCHMIDT: Some experiments on the influence of light on hair growth and its therapeutic use in alopecia areata.

From the Royal University Polyclinic for Skin and Venereal Diseases in Berlin (Dir. Prof. Dr. E. LESSER).

Archives of Dermatology and Syphilis, 1902, Vol. LXII, 2nd-3rd Notebook,

The author first describes some animal experiments on the possible influence of light on the speed of hair growth: A number of guinea pigs, on which evenly lying parts of the skin had been epilated, were placed in different boxes. Some of these were uncovered, so that the animals were exposed to full daylight, and at times to direct sunlight or electric light. The other boxes were covered with red glass, so that the animals were protected from all strongly refractive rays. After a few weeks, the length of the newly grown hair of the different animals was then compared. The increase in length proved to be somewhat different individually, but completely independent of whether the animals had been exposed to the light or not. The experiments seem to have been carried out with such care that there is no reason to doubt the correctness of the results; but it must be borne in mind that concentrated light in many cases has an effect which weaker, unconcentrated light is incapable of producing, and the experiments would therefore have gained much interest if they had been supplemented by some investigations into the possible action of concentrated rays would be.

Following the animal experiments, the author reports two cases of alopecia areata treated with light. The first case was treated by Finsen's method with concentrated electric light using pressure-glass, while the second case was treated with unconcentrated electric light at a distance of 1 m from the lamp. The first case was cured, while in the latter no beneficial effect of the Light was felt. The author now concludes that the last case is not about

a parasitic disease may have acted, since otherwise the light would have had to act as a result of its bactericidal ability. The author's conclusion may be correct, but the reasoning given shows that he lacks an understanding of the difference in the bactericidal effect between strong and weak light. If the author were to order a lupus patient to walk in the sun for an hour a day and this treatment produced no improvement, such a reasoning would lead him to deny the possibility of a bacterial etiology concerning this disease as well! A simple calculation shows that the last of these two patients was treated with a light several hundred times weaker than that used on the first patient, and no pressure-glass was used. As a replacement, the last patient was most certainly treated in longer sessions than the first. acts, but in relation to the enormous differences in light intensity, this plays only a minor role. That the intensity of unconcentrated light at a long distance from the lamp is really so many times less than the intensity of concentrated light can be easily and quickly demonstrated by the following experiments: A piece of silver chloride paper is placed in an ABSALON LARSEN actinometer and e.g . B. exposed for 5 seconds with concentrated light. The degree of blackening obtained will then correspond approximately to that which a second piece of silver chloride paper placed in the actinometer will attain after 30 minutes' exposure to unconcentrated light at a distance of 1 m from the arc. The intensity of the light is therefore about j60 times weaker in the last case than in the first. Such a weak light can probably produce a surface culture in a short time (approx. 5 minutes), e.g. B. of Bac. kill prodigiosus, but

be considered impossible from the outset, that it can kill bacteria that lie in the skin and are therefore protected by the skin.

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got to

FRANZ NAGELSCHMIDT: On the theory of curing lupus by light.

From the Royal University Polyclinic for Skin and Venereal Diseases in Berlin (Dir. Prof. Dr. E. LESSER). Archives of Dermatology and Syphilis, 1902, Vol. LXIII, Issue 2-3,

The question of what is the most important cause for healing in light treatment of lupus vulgaris: the bactericidal nature of the light or the light reaction in the tissue or possibly both parts together. taken, has only recently been made the subject of direct experimental experiments'), nevertheless the theoretical views in this

1) The question was picked up at the laboratory of the local Light Institute at this time.

thing were and still are very divergent. Whilst FINSEN considered bactericidal activity to be the most essential factor or at least to be on a par with the reaction to light, many authors, especially in recent years, have come to the view that healing is based exclusively on reactive inflammation and the hyperemia associated with it due to the tuberculous skin area.

In the above-mentioned article, the author reports some interesting animal experiments, which bring us one step closer to solving the question.

The procedure in these experiments was as follows: The author rubbed a virulent culture of tubercle bacilli into a scarified area of skin of a guinea pig, 18 days later, after a marked tuberculous skin infiltration had developed, this was irradiated for one hour with a concentrated electric light from an 80 amp. -Lamp illuminated. The exposed piece of skin was immediately excised and macerated in bouillon before the reactive inflammation of the skin had time to develop and take effect. Three guinea pigs were inoculated intraperitoneally with this.

Out of nine guinea pigs which were inoculated with tuberculous tissue in this way in three series of experiments, only one contracted tuberculosis (urogenital tuberculosis!), while the other eight remained healthy. The observation period was 7-14 weeks.

On the other hand, all the control animals (30) which were inoculated from similar but unexposed tuberculous areas of the skin contracted tuberculosis more severely or less severely.

The author has proved by these excellent experiments that concentrated light is capable of killing tubercle bacilli in living tuberculous tissue. The result is certainly not overpowering. surprising when one considers how surely and rapidly bacteria in artificial culture media are killed by light, but it gives us a point of evidence in the controversy as to whether to ascribe to bactericidal activity or to reactive inflammation the supremacy as the curative factor of light treatment in lupus vulgaris is.

GUNNI BUSCK.

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OUT

FINSENS MEDICINSKE LYSINSTITUTE

(FINSENS MEDICAL LIGHT INSTITUTE)

IN COPENHAGEN.

PUBLISHED BY

PROF. DR. NIELS R. FINSEN.

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Contents.

Light treatment results on our first 800 cases

from lupus vulgaris.

(Continued from: The application of concentrated chemical light rays in medicine. By Niels R. Finsen. Communications from F. m. L. III, S 1).

Results of the light treatment in our first

800 cases of lupus vulgaris.

Of

Niels R Finsen and H Forchhammer.

(Continued from: The application of concentrated chemical light rays in medicine. By Niels R. Finsen. Communications from F. m. L. III, S 1).

With a disease like lupus vulgaris, so chronic in its course, and so marked in its tendency to recur even after a long period of apparent cure, it is necessary to arm oneself with great patience when trying any particular method of treatment and drawing firm conclusions as to its effects want.

Even if one has a large amount of material, the results only become valuable after the cases have been followed for some time after the treatment has been completed. Our experiences, which now include about 950 cases of lupus, which we have observed with great attention, have sufficiently demonstrated the impossibility of deciding whether an apparently cured case is definitely cured or whether there are still invisible germs of disease which will sooner or later create a new one could cause an outbreak. To say a priori how long one wants to spend observing seems quite arbitrary; messages from Finsen's medical light institute can be practical.

1

v, vi

be content with a few years, since recurrences after such a long time are quite rare.

Proceeding from these views, which were already indicated in our first publication in 1896, it is only now, after the light treatment of lupus vulgaris has been used for seven years, that we present a detailed account of its results. Of course, we have repeatedly published communications about the method and its effects; but we have intentionally been very cautious in our claims as to the definitive results; among other things, we have avoided the expression "cured" as much as possible, preferring the expression "main treatment complete" to indicate the possibility that "post-treatment" may still be necessary. We have placed significantly more emphasis on this, with the help of pictures and to illustrate the effect of light treatment by demonstrating treated patients.

Not infrequently, we have been reproached, especially from abroad, or we have been expressed astonishment that we have not yet given a detailed report on our results. We preferred to wait until our material seemed really valuable to us and our own view of the method was clarified in the essential points. We have been able to act without haste, working under favorable external conditions and constant and plentiful access to patients. We have also felt particularly compelled to be cautious, since this was not just a new treatment for lupus, but something much more, namely the introduction of an entirely new therapeutic agent, "the chemical rays of light," into the treatment of skin diseases. We had to assume that there was a particularly great deal of skepticism to be overcome here and that it was therefore doubly important to provide the proof as thoroughly and reliably as possible .

Our report includes the first 800 cases of lupus vulgaris treated at the Light Institute over the 6 years from November 1895 to November 1901. The report on which the illustration is based was completed on October 1, 1902, and the patients have remained under observation up to this day if possible. So even the most recent arrivals have been under treatment or observation for almost a year.

The processing of such a large material naturally involves certain difficulties, especially in view of the limitations of the material. However, as it has not been our intention to give a monograph of the disease, but only an account of the results of light treatment, it is chiefly with this in mind that we have drawn the limits of our task. In the schematic representation, which we have had to use for the sake of clarity, we have included, apart from the light treatment and its results, only that which can serve in an easily recognizable way to illuminate and characterize the patient material with which we were working.

The scheme provides for each patient: 1. Number, 2. Gender, 3. Age, 4. Duration of illness, 5. Spread

4 and location of skin condition, 6. its complication with mucosal lupus, 7. light treatment: when it started, the number of individual treatments in each year, and when it is finished; finally, as the last and most essential rubric, 8th result.

As a supplement to this brief schematic, we have included a number of more detailed case reports, first on 122 healed patients who remained free of recurrence for a period of 2-5 years, then on 13 healed patients who remained free of recurrence within the first two years after the completion of the treatment have died. The collected number of medical reports is dem

after 135.

Finally, a number of photographs, forty-eight pairs in all, are attached, all taken at the Institute, and showing patients before and after treatment. With the help of these images it has been our intention to show the cosmetic value of the results which cannot be illustrated in any other way. Therefore, in addition to the healed patients, we have added some who are not completely healed, but which particularly clearly illustrate what the light treatment has been able to do.

accountability for the scheme.

In the following, we want to give a brief account of the various categories in our patient schema and illuminate them with a few countable accounts. At the same time, we want to take this opportunity to touch on some of the relationships that it was not possible to mention in the brief schematic representation:

1st number.

I

In the first column of the scheme, the numbers under which the patients are entered in the main journal of the institute are listed in consecutive order from 1 to 800.

The number in bold refers to the more detailed case reports, while an asterisk in front of the number refers to the illustrated plates by way of a footnote.

2nd sex.

This is denoted by M. (male) or W. (female). Adding them up gives a large majority of the female sex, namely: the number of women is 582 = 73%

Men 218= 27%

3rd age.

Age is given in completed years; the distribution in the various age groups is as follows: Under 15 years 84 15 — 25 273

under 25 years in total 357 cases

-45%

25-35 183

35--45

25 - 45 years a total of 305 cases

= 38% 45-55

86 55 - 65 About

14

over 45 years a total of 138 cases = 17%

1 22

38

65

As can be seen, our clientele included all ages from children to the elderly (the youngest patient was less than one year old, the oldest was 74 years old). The distribution is not even; actual childhood is represented only very weakly, adolescence most strongly, after which the number gradually decreases with the years. the

The majority, about 3/4 of the cases, are between the ages of 15 and 45.

4. Duration of Illness. This is calculated from the point in time at which the skin disease was recognized, and in the numerous cases where the disease began as a disease of the mucous membranes, this is not taken into account.

In a disease as chronic and insidious as lupus, any indication of the duration of the disease will always be approximate and the average numbers will be underestimated.

The average figure for the stated duration of illness in all cases is about 11 years. Disease duration less than 2 years: 82 cases

5

148 5 — 10

187 under 10 years in total 417

Cases = 52% disease duration

15 years 145 cases 15 – 20

95

2

As can be seen, only a relatively small number of cases came under light treatment soon after their occurrence. Almost all of our patients have tried other treatments before.

There are of course a number of missed and ill-treated cases in our material, but on the contrary many have been treated for years in various ways and with much energy without result. A representation of

" earlier treatment" would offer much interest; but the material has been too overwhelming to be included in the diagram; on the other hand, it happened in the more detailed case reports.

5. Spread and location of skin condition.

We have divided our cases into 4 groups and according to size: "Small"

=up to two-mark piece size (approx. 10qcm), "medium-sized"

Map size (approx. 50 qcm), "Large"

" double (approx. 100 qcm), "very spread out" = over 100 qcm.

This classification is arbitrarily chosen for the practical purpose of using commonly known notions of size. We were able to carry out the distribution within the groups with a high degree of certainty, as we carried out an exact measurement system in our medical journals and took photographs of each patient. With a subtraction we get: Small cases

244 medium-sized

213

Smaller cases (less than 50 sq cm 457 = 57%

Size

Cases 184

Very spread

159

Larger cases (over 50 sqm 343 = 43%-

. It might seem biased to classify cases only by their areal spread; but partly it is the only objectively reliable classification, partly this circumstance is of the greatest importance for the light treatment, which can affect only a limited portion at a time. Quite as important as the extent of the suffering is the depth of it, as it is clear that in deep infiltration the penetration and action of the Light must be impeded. But these two circumstances usually coincide, so that the more limited cases are usually superficial, while the more extensive ones at the same time go deeper. On the whole, therefore, the spread of the skin disease gives a good basis for judging the case, which we shall see confirmed later when discussing the results.

The usual dermatological divisions are of little value to our material, with its large number of inveterate cases, where the original disease picture has been more or less obliterated.

It would lead too far to go into the regional distribution, which is shown in the scheme. It should only be mentioned that the face was affected in 760 cases = 95%.

6. Mucosal Lupus.

This is given in its localization; in cases where the mucous membranes are not affected, this is marked with a dash. A recount reveals the extraordinary frequency of this complication. Mucosal affection is proven in 572 cases = 72%

Not

2 28

28% The nasal cavity is affected most frequently, followed by the lips, mouth, pharynx and larynx. The rarer cases in which the mucous membranes of the eye are affected have not been included in the scheme. We have not noticed any locations other than those mentioned here.

Affections of the mucous membranes have to be content with a modest place as a complication of the main disease. In reality the relationship is quite different, in that the disease very often begins on the mucous membranes and only secondarily attacks the skin; but we must refrain from a more detailed discussion of these conditions in this work. The same applies to the question of the coincidence of lupus vulgaris and other tuberculous diseases. Only with regard to pulmonary tuberculosis we have made an exception because of its importance for the results of the treatment and in the column "Result" in all the cases where we have found stethoscopic signs of pulmonary tuberculosis Tb. pulm. find inflicted. When summed up, one sees that pulmonary tuberculosis in 125 cases = 16%

is found. 7. Treatment We have only listed the light treatment in the scheme. For each patient, the date of the start of treatment, the number of sessions and the date of the last treatment are given; where a dash is noted in the scheme instead of the date, this means that the patient was treated after December 31, 1901. The stated number of sessions is thus too low for the patients whose treatment was continued in 1902 or is completed.

About the light treatment, since the scheme only gives an explanation of the number of sessions, we want to add the following.

The light sources used were partly the sun and partly electric light.

Sun treatment has only taken place in the summer and only on our comparatively few clear sunshine days; it was chiefly employed in the early years, but has been almost entirely abandoned in recent years, as we consider it considerably less effective than our present electric light treatment.

Electric light treatment has undergone constant improvements over the years. We will discuss the very important question of the importance of luminous intensity later. The most essential and significant improvement, the introduction of rock-crystal lenses instead of glass, and the simultaneous introduction of water-cooling of the pressure-glasses, by which it is possible to use light twice as strong as before, dates from the beginning of the summer of 1898, about the time we are with patient No. 140 were.

Other dermatological treatment was only of minor importance next to the light treatment. Until the spring of 1898, only the light treatment was used, since it was a question of investigating the effect of a completely new therapeutic agent. Later we have occasionally resorted to other methods, especially to prepare for the light treatment in large and neglected cases.

The treatments we have used the most are the following:

1. BESNIER's pyrogallic ointment, used in all in 223 cases, of which 8 were small, 37 were medium-sized, 75 were large, and 103 were very extensive; it is used as a preparatory treatment in deeply infiltrated and, as can be seen, chiefly large cases.

2. Scraping out with subsequent burning (like Paquelin] is sometimes used, especially in hypertrophy with ulceration of the lips. Galvanopuncture was often used for isolated, deep and very small nodules.

Finally, it must be remarked, that after the introduction of the rock-crystal lenses, the light reaction became so intense in the formation of exudation and vesicles, that the application of bandages was necessary to avoid contamination; mainly indifferent ointments and poultices were used for this purpose.

General treatment naturally plays a role in a tuberculous disease such as lupus vulgaris. It must therefore be expressly emphasized that the majority of our patients are exclusively outpatient during treatment

lived under very poor circumstances. As far as possible we have tried to remedy this by distributing milk, hematin albumin, etc., free of charge to the poorly nourished patients. In addition, a small lounger has been built in the garden of the institute for summer use.

The treatment of the mucous membranes has also been completely omitted in our scheme. In some cases on the lip, tongue and gums we have used the light treatment with success; but otherwise we resorted to other means. We attach the greatest importance to the treatment of mucous membrane diseases, and on the whole have good results from them. The means which we have used with considerable success are galvanopuncture and brushing with a strong iodine-iodine-potassium solution (1 part iodine, 2 parts iodine-potassium and 2 parts water) after preceding cocainization; also careful cleaning by means of rinsing; in the nose tampons with sublimate solution (1%).

8. Result.

In the case of such an intractable disease as lupus vulgaris, the "response result" after institutional treatment is of relatively little importance; for even if there are no visible symptoms of disease at this time, there may very well be hidden foci, as we have pointed out above, which sooner or later will break out. Of course, this applies to the light treatment as well as to any other treatment. We therefore never label our patients as 'cured', but rather prepare them for the likelihood of new outbreaks requiring follow-up treatment; and we aim to keep them under observation for as long as possible.

The results we have compiled therefore do not mean tender results, but they should by no means be regarded as definitive results; they only give an overview of the condition of the patients at the last observation (or communication) before the conclusion, which took place on October 1, 1902.

We have used the following expressions in the scheme:

1. Healed, which is to be understood with all reservations and only indicates that there were no visible signs of illness in such and such a long time. Concerning the cases where this observation time was two years and more, a reference to the somewhat more detailed special case reports is added, while an asterisk appended to the word "cured" means an observation time of less than two years.

2. Almost healed denotes such cases where symptoms of illness are still present, but only as insignificant remnants, and where there is a prospect of complete recovery

good is.

3. Partially cured and 4. Significantly improved designates similar cases where the effect is definitely favorable, but the prospects of a complete cure are less

are good.

5. Temporary improvement and 6. Slight influence do not require a more detailed explanation, they contain cases where the light effect has been less favorable but the treatment is still continued, either because the hope of a cure has not been entirely given up or because the light treatment has prevent further spread of the disease.

7. UK (unfinished course) includes the cases where the treatment is discontinued because of negative result or death or illness, or because the patient stayed away for this or that reason.

In addition to these main descriptions, individual small explanations are given under the heading "Result", as far as space allows. Among other things, as mentioned earlier, it is noted if the patient has had pulmonary tuberculosis at the same time.

The patient material.

Before proceeding to a more detailed discussion of the results, we must briefly review our patient material.

As for this, it should be noted that it is not made up of specially selected cases, in that we accepted in principle all lupus patients who turned to us, from very small and

, fresh cases to the most common and obsolete, those that had never been treated before and those that had tried every possible treatment for decades and were considered incurable. During the 7 years that we have been using the treatment, we have turned away only a few patients whose condition for other reasons seemed utterly hopeless.

The majority of our patients were Danish, namely 676 against 124 foreigners. The Danish patients have come from all over the country and the vast majority belong to the poor class - down to the residents of the poor house. There are a number of wealthier patients among the foreigners, but the majority belong to the people of our neighboring countries, North Schleswig, Norway and Sweden, so that no significant shift in social terms can be noted as a result.

By comparing what has been communicated here with the explanations provided by the scheme, the following picture of our clientele can be sketched very briefly.

By far the largest part belongs to the poor classes, although other classes of society are also represented.

We had all ages, from infants to the elderly, but most were in their youth or old age.

As for the disease as such, the picture is of the most serious kind:

The average duration of the disease was 1 year; about half of all cases 383 out of 800 had existed for more than 10 years and only a small fraction

had come within the first 2 years after the onset of the disease. About half

343 out of 800

had a spread of over 50 sq cm and of these 159 were at least twice as spread.

The face was affected in the great majority of cases, 760 out of 800, and it is precisely with this that affections of the mucous membranes of the nose, mouth, fauces, and throat were so frequent

572 out of 800 cases.

As our report covers a 6 year period, it may be of interest to see how our clientele's appearance has changed over time. With this in mind, we divided our 800 cases into 8 groups of 100 each. As detailed in the table below, the first group covers a period of approximately 21/2 years, while each of the following ones covers approximately 1/2 year.

In the table we have for each of these 8 groups the distribution according to resp. Sex and age of the patients and presented according to the duration and extent of the disease. As the table shows, the distribution of our cases by gender and age has been fairly similar over the years. On the other hand, a clear change can be observed for the skin condition as such.

Regarding the duration of the disease, we see that the number of inveterated cases aged 10-20 years or more has remained fairly constant. Within the "fresher" cases, however, there is a shift in favor of an encouraging increase in the number of cases treated over the course of the first two years of illness.

The difference is most marked, however, when one considers the spread of the skin condition, in which there is an apparent increase in the "smaller" cases and a corresponding decrease in the "larger" cases. Let's collect the cases so that we have the first 400 (Nos

date of 20./11.95 – acceptance.

11./2. 98

-15./9.98-17./4.99 — 2./9. 99 -23./3.1900 -1./10.00-20./4.01-21./11.01 Consecutive number I-100 101-200 201-300 301-400 401-500 501-600 601-700701-800

Throughout

III

85

400) compared to the last 100 (Nos. 401-800), we find Nos. 1-400: 104 small, 102 medium-sized, 99 large and 95 very broken. "401-800: 140

64 As mentioned, 676 of our 800 cases are from Denmark; the influx has been fairly even from all parts of the country and almost all doctors in the country have sent their lupus patients to the institute. The decrease in the large and inveterate cases mentioned is certainly to be regarded as a sign that the greatest number of them have already come under treatment. However, we have not yet gotten to the point where we can state with any degree of accuracy the total number of lupus patients in Denmark; there are certainly a number of cases, especially those involving only the extremities or the body, which do not come under treatment, as they only slightly embarrass the patients, and it must also be borne in mind that the majority of cases go undiagnosed before they have existed for any length of time, so that at any given time there will be a fairly large number of unrecognized cases. It seems as if the number which we arrived at earlier1 by a superficial calculation, namely about 1300, 1/2%, corresponding to the population of the country, was reasonably correct, perhaps a little too high.

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The results of the light treatment.

We now proceed to our main task highlighted in the introduction, an illustration of the to give results obtained by means of the light treatment of our 800 cases; at the same time let us seek to determine what influence the various circumstances discussed above have exerted on these results.

Beginning with a simple enumeration of the designations given in the schemes, for the sake of clarity, let us divide them into five groups, of which Group 1 includes those cases which were apparently cured at the conclusion, Group II those which indicated an imminent cure, Group III those on whom the influence was absolutely favorable but where the prospect of complete cure is doubtful, Group IV those for whom

1) NR FINSEN: Studies on the incidence ratio of Lupus vulgaris in Denmark. Communications from F.m.L., II., p. 139. Communications from Finsen's medical light institute.

v, vi

2

the effect of light treatment was insufficient, and Group V those who died or gave up light treatment for reasons not attributable to the method.

Of our 800 cases, termination I. was apparently cured

407 = 51% Of these a) free of recurrence in 2-6 years

b) with observation under 2 years 285 II. Almost healed

193 = 24, III. Significantly improved

89=11, Of these a) partially healed. b) significantly improved

65 IV. Not influenced enough

Of these
a) temporary improvement

14
b) low impact
c) UK -- Negative result

14

I 22

24

40

5 ,,

I 2

.

V. Abandoned

71 9% Of these a) UK death

33

b) U.K. disease

13

c) UK

absent

25 So in total 407 were cured while 85 had discontinued treatment for various reasons (UK); of the remaining 308, the majority were still under constant or temporarily discontinued treatment, while some had discontinued treatment, being satisfied with the relative cure achieved.

Let us first direct our attention to the fact which is immediately apparent, namely, that the beneficial effect of the light has been remarkably constant. To prove this with numbers, we need to exclude group V. Of the remaining 729 cases, the first three groups with a total of 689 cases or 94% are all positively affected, while only the 40 cases in group IV, a total of 6%, have had little or no benefit from the light treatment.

We must take this opportunity to note that the light treatment did not cause any harmful side effects and never resulted in any loss of substance. This gives both physicians and patients a sense of security which is of great value and is found by many patients to be very beneficial in contrast to what they have been through in the past. This is probably also due to the fact that the number of those who did not take the cure (UK - stayed away) is so extraordinarily small, 25 = 3%.

Now let us examine the results obtained by briefly discussing each of the groups listed above.

0

.

99

48

2

2

I. Apparently cured. This group comprises 407 cases in all, which showed no signs of illness at the time of termination. So we managed to achieve this result in just over half of all cases.

With regard to the question of definitive healing, it is of course important how long these 407 patients have been free of recurrence and when adding them up you will find the following distribution: Recurrence-free over 4 years.

15

in

3-4 years

-3

59

3/4

205 After December 31, 1901 treated 80

As previously mentioned, we have set a limit of two years of observation, and for those patients who have been free of recurrence for two years in all, we have given more detailed case reports in a special section. To this end, 13 medical reports are attached on cured patients who died in the course of the first two years after the end of treatment (these cases are indicated in the scheme with “cured*dead”). The observation time, as far as this was concerned, was 1-11/year in 5 cases, 1/2-1 year in 7 cases and less than 1/2 year in 1 case.

If we arrange these 407 healed according to their age and according to the duration and spread of the disease, we find the following distribution: Age of the patient

under

15 years 52 = 12.5% 15-25

161 =

= 40

2-IO

duration of illness

under 2 years 54 -- 13%

189= 47 10--20

III = 27 over 20

53 = 13 spread d. Skin disease: Small cases

179 = 44 medium size cases

123 = 30 Big Falls

68 :17 Very broken out. Cases 37 = 9 We find here the same varied picture of all disease classes and degrees of disease as in the collected material (see table on p. 16). However, on comparison, it will be seen that the more recent and less widespread cases predominate, while, as might have been anticipated, we have succeeded in curing a proportionately smaller number of the more widespread and obsolete cases.

The numbers we encounter here give us a better idea of the efficiency of the light method than a long description. Of those cured, 105 were large and very extensive cases, and 164 of the patients had had their disease for more than 10 years. The following table shows the more detailed distribution: disease duration 10--20 years

20-30

37

30--40

13

about _

40

3 We may add that affections of the mucous membrane are found as frequently as in the collected material, viz. in 293 cases (72%), while pulmonary tuberculosis only in 39 of the healed = 10%

% was stated (in the collected material it was 16 percent).

III

II. Almost healed. This group includes 193 cases, which at the conclusion were not quite finished with treatment, but seemed near recovery. Here are mainly such cases which for one reason or another were more difficult and required a particularly long treatment.

Photographs are included for some patients in this group to characterize the nature of the cases (see Plates 9, 18, 26, 28, 29, 31, 41, 47).

If we arrange these 193 cases according to the age of the patients and according to the duration and extent of the disease, we find the following relationships: Age of the patients

under 15 years 12 = 6% 15-25

65 = 34, 25-45

77 = 40 ,

over 45

9

=

8th,

99

IO-20

62

16,

= 29,

.

duration of illness

under 2 years 15
2-10

73=38 ,

- 32 , over 20

43

= 22, Spread of skin l.: Small cases

30 medium-sized cases. 56 Great Falls.

very erupted Cases 52 = 27. Comparing these figures with those concerning the cured patients, we see that the older age classes and the more widespread and old-fashioned cases are comparatively well represented in this group. -- diseases of the mucous membrane are found in about the same percentage as in the whole material, namely 143 cases (74%); the

55 = 28th,

99

99

the same applies to pulmonary tuberculosis, which was found in 33 cases (17o7.).

We see, therefore, that the difficulty of treatment bears a certain relation to the extent and duration of the skin disease. With regard to some of the cases, and this is particularly true of the less widespread cases, we can also demonstrate other reasons; in 46 cases, irregular treatment is considered a contributory cause, attributable to either the patient's lack of ability or lack of will to carry out the treatment with energy. In 17 cases malignant mucosal disease gave rise to repeated new outbreaks and thereby delayed healing, in 25 cases treatment is finally completed because the patients were satisfied with the relative healing achieved or because they preferred to continue the light treatment in their to continue birthplaces.

III. Significantly improved.

This group includes 24 partially cured and 65 much improved, altogether 89 cases still under treatment at closure. In these cases the light treatment had had an unconditionally beneficial effect, but the prospect of a cure was doubtful. Here our difficult and obstinate cases are found to a still greater degree than in the previous group

If we group these 89 cases according to the age of the patients and according to the duration and extent of the disease, we find the following relationships:

over 45

2-10

10-20

25 =

:

.

10

:44 ,

99

age of patients

under 15 years 13 =15% 15-25

24 = 27, 25-45

27 = 30 ,

25 = 28 , disease duration

under 2 years 4= 5%

33 = 37

27 = 30 , over 20

= 28 , Spread of skin l.: Small cases

7

80% Medium sized

I= 12 , large

32 = 36 , Very widespread 39: Comparing these figures with those of the preceding groups we find a preponderance of the older age groups, and a still more striking one for the widespread and obsolete cases. We must add that the diseases of the mucous membrane are somewhat less frequent 60 cases = 67% Pulmonary tuberculosis somewhat more frequent 20 cases = 23% than in the whole material.

We see here clearly the importance of the extent of the skin disease, since the great majority within this group consists of cases which, despite long-term treatment, have not been cured. For the largest percentage of these cases, the prospect of a complete cure is slim, the disease has progressed so far that the patients must be regarded as invalids. For these unfortunates, whose face is usually so grossly disfigured, the light treatment offers the great advantage of almost constantly preventing the disease from spreading further, and can often improve the condition of the patient to the extent that they lead a reasonably human existence and can fully or partially use their ability to work. For the 18 less widespread cases that make up this group, either irregular treatment or malignancy of the mucous membranes can be cited as the reason why treatment was prolonged.

IV. Not influenced enough. This group includes a total of 40 cases, of which 14 are labeled "Transient Improvement", 12 are labeled "Minor Effect", while 14 have discontinued treatment (.UK Negative Result).

It deserves to be emphasized how small these numbers are

altogether only 5% of all cases and especially how few patients, 14 = 2%, had to give up the treatment because of a bad result.

Temporary improvement. The 14 cases under this rubric must be discussed separately. They were all improved by the light treatment, but the disease quickly broke out again; time and time again it has been possible to achieve an apparent cure, but only temporarily. The majority of these cases II of 14

have spread little and have apparently been quite favorable cases.

The cause of the recurrence was in most cases to be traced back to malignant diseases of the mucous membrane, which it was not possible to treat (see patient nos. 17, 100, 138, 351, 364, 376, 450, 557), in a single case it is great poverty, where recurrences have broken out in connection with repeated diseases (n. 288); in the remaining five cases we cannot cite any particular reason why the disease could not be cured (nn. 93, 112, 142, 153, 332).

Low impact and negative result. This includes a total of 26 cases. The majority of these cases, 15 in number, in which light treatment failed completely, were hopeless from the outset because of the enormous extent of the disease and the deep infiltration of the tissues (Nos. 4, 21, 23, 37, 47, 63, 109, 151, 186, 214, 223, 317, 340, 420, 685), but there remain cases of minor extent in which we have not been able to prove any particular cause for the lesser effect (nos. 8, 69, 114, 146, 193, 305, 343, 458, 480, 498, 679).

Of the 26 cases listed here, 12 are listed under the label “Minor Impact” while 14 are labeled “UK Negative Result”. While the effect on these patients was about the same, the difference is that the last

14 have given up treatment, while the first 12 are still on treatment or occasionally receive treatment because the light treatment does prevent the disease from spreading further and can improve the situation a little.

It may be mentioned here that a comparatively large number of these bad results occurred in the early days of the institute's existence, when the light apparatus was weaker and the treatment on the whole more uncertain than later. We calculate this “trial period” up to the summer of 1898 and this includes our first 140 patients. As can be seen from the numbers, no fewer than 15 of this group of 40 patients fall within this trial period.

V. Abandoned. This group contains a total of 71 cases in which the treatment was broken off for reasons which cannot be attributed to the method. In 46 of these cases the cause was due to serious illness, which resulted in death in 33 cases and in 25 cases the cause was of another nature.

The light treatment has been beneficial in most of these cases. On examining the individual cases one will first find cases in which the treatment was so short that there could be no question of any effect; of the remaining 60 cases

14 almost healed,

35 significantly improved,

11 little affected; of these u patients, 6 suffered from serious pulmonary tuberculosis.

Under “UK death” and “UK illness” fall resp. 33 and 13 patients, or 46 in all. As the cause, pulmonary tuberculosis takes the first place with 27 cases, of which 21 died; of the 27 cases, 13 are in young people under the age of 25, all of whom have died. Other causes of death that occur with some frequency are vitia cordis and carcinoma, each with 4 cases.

It is natural that in this group there would be a number of older individuals, of the 46, 15 were over 45 years of age

. old; likewise the large and old cases predominate. It should be added here that among the “healed” there are 15 patients who died after the treatment was completed (see medical reports no. 47, 59 and 123-135). The cause of death in 7 of these cases was internal tuberculosis.

Altogether 58 of our 800 patients died, 28 of them from internal tuberculosis.

“UK Absent” refers to 25 patients who discontinued treatment before a fully satisfactory outcome was achieved. 5 of these patients left the institute after a few hours of treatment without giving any reason (No. 205, 397, 428, 457, 608). In 9 cases it is due to indifference or lack of energy in the patients (No. 53, 57, 157, 168, 229, 255, 260, 384, 501). - Finally, in 11 cases, although the treatment was given free of charge, economic difficulties prevented it from being carried out (Nos. 10, 12, 166, 226, 281, 284, 315, 339, 348, 386, 472). Considering that the majority of our patients belong to the poor class, this number must be described as surprisingly small.

Which circumstances are important for the results.

We have previously discussed some of the difficulties we have encountered in treating our lupus patients; we have seen that there were some cases which defied treatment, without being able to point to any particular cause; but at the same time we saw that these cases were remarkably sparse. We have once expressed this rather constant effect of light treatment in lupus by saying that unless a case of lupus is favorably influenced by the light, one can almost be inclined to doubt the correctness of the diagnosis. Although this judgment is very strong, it must be admitted that there is some justification

has.

Of the circumstances which have an influence on the results, there is not a single one that is as important as the spread of the skin disease and the deep penetration into the tissues which is often associated with it. Before proceeding, however, to a fuller discussion of this circumstance, let us very briefly discuss the various other factors, more or less important, which might have bearing on the results.

As is well known, the general state of health or the state of nutrition play a not inconsiderable part in lupus, as in other tuberculous diseases, and we have often had occasion to observe that the results of light treatment are often adversely affected by poverty and bad nutrition.

Concomitant pulmonary tuberculosis, which we could detect in 1 25 out of all 800 cases or 16%, must of course be considered an adverse complication; this disease has caused 28 deaths. The majority of our cases , however, were of a very benign nature, and we have not been able to prove numerically any more significant adverse effect on the healing of the skin disease.

As mentioned earlier, we found mucosal lupus in 572 cases or 72% of all 800. We do not want to go into detail about this very serious complication in this work, since in most cases it cannot be subjected to light treatment. We will only remark that the treatment requires a great deal of care and patience; usually one will then also be able to achieve a cure; but, as we have mentioned in several places above, and as we shall see hereafter, it very often happens that a mucosal malignancy has again and again given rise to cutaneous eruptions, thereby delaying or rendering impossible the healing of the skin ailment.

The importance of the duration of the disease for the cure rests essentially on the fact that the skin disease usually increases in extent in the course of the years, so that the new cases are often small and the old cases are extensive. We can mention here that of the 82 cases of less than two years' duration, 60 were small, 19 were medium-sized and

only 3 were large, while the 143 cases of more than 20 years' duration comprised only 14 small and 30 of moderate size, but 46 large and 53 very extensive. On examining the importance of the duration of the disease in cases of the same size, we have found that the results of light treatment are somewhat better for the fresh than for the old. However, we must add that such cases, which attain a large extent in a short time, usually offer a poor prognosis.

Examining the influence of the patient's age in otherwise similar cases, we found that the chances of recovery were about equal,

the patients under 45 years old, while the conditions for older patients were significantly less favourable.

The extent of the skin ailment, as mentioned, is the factor which has the greatest importance for the treatment and its results, so that it can usually be said that the more widespread the affliction, the more time-consuming the treatment and the more doubtful the result. This is clearly shown in the table below, in which the cases are divided according to their extent and then again into different groups, which contain the results with the addition of the percentage.

if

The difference becomes most striking when we compare the two extreme points, the small and the very extensive cases. While 73% of the small ones have healed, only 23% of the spread ones have succeeded. This difference is not so great when we take into account the nearly cured cases; but that their number is so great among the widespread cases shows that the treatment is often particularly time-consuming. The difference, however, does not lie in the fact that a particularly large number of the cases spread are only slightly affected by the Light, for we have obtained substantial improvement in a large number of cases, but we have mentioned at the same time that the majority of the cases in this The cases cited in the group offered little prospect of a complete cure.

By a more detailed discussion of these two groups, the small and the very extensive cases, we shall try to determine the limit of the power of light treatment.

Very widespread cases.

The Ver

The number, as mentioned earlier, is 159.

, division was:

4%

0

over 45

= 24% 43% 33%

0

0

Age of patients: under 15 years 6 cases

15--25

51

32% 25-35 63

39% 39

25% Duration of illness: less than 2 years

0 cases 2 - 10

37 10---20

69 over 20

53 Pulmonary tuberculosis is detected in 34 cases = 22%

== % As can be seen, these patients all, but mostly belong to the older age groups; in 3/4 of the cases the disease has existed for more than 10 years. The result which we have obtained in these malignant cases is quite representative of what the method can accomplish, in that, as appears from Table p. 31, 89 of the 159, or 56 per cent, are apparently or almost cured; and how serious the cases were is perhaps best seen in the accompanying photographs (see Plates 2, 8, 9, 10, 12, 14, 15, 16, 18, 24, 26, 28, 31, 36, 44, 46); but on the other hand some of these cases are to be regarded as incurable even for light treatment.

small cases. The total number was 244; the distribution: age of patients under 15 years 50 cases = 2000

15-25

82

:34, 25-45

88

= 36th, 24th

= 10 , disease duration. under 2 years 62 cases

- 259;0 I 25

:51 ,

over 45

2

- 18 ,

6,

pulmonary tuberculosis has been detected in

14

28 cases= 120

As you can see, all age groups are represented, but the older ones are relatively weak. The duration of the disease is less than 10 years in 3/4 of the cases. If we subtract the 57 cases in which the disease has existed for more than 10 years, we get 187 as a remainder. These cases are of particular interest to us, since we naturally expect to receive treatment for lupus patients in the future, where the cases are still small and are fresh. The results obtained here must, therefore, first serve as the real measure of the value of the treatment, and we shall therefore subject them to a special discussion.

Overview of 187 small cases from below

io-year duration of illness.

2

99

.

0

1. A total of 142 or 76% were cured, of which more than . 3 years 26

3

32

3/4-2 67 treated after Dec 31 1901 .

17 II. A total of 20=11% were almost cured. Of these, 2 have left the institute to continue the light treatment in their home country and both are now, as far as we know, cured. If we want to investigate the reasons for the long-term treatment with regard to the others, we find irregular treatment in 6 cases,

Malignant mucosal diseases (1 Tbc. pulm.), no particular reason could be demonstrated. III. A total of 5 cases = 3% were significantly improved. In all 5 cases, a malignant disease of the mucous membranes gave rise to the prolonged treatment. Messages from Finsen's medical light institute. v, vi

3

ok

2

3 Attributable

2

IV. In total 10= 5% were not sufficiently influenced. A temporary improvement was achieved in all of them as a result of the light treatment. The cause of the repeated recurrences was

in 5 cases malignant mucosal diseases,

5

other adventitious diseases while

no particular reason could be demonstrated. Only one of these patients discontinued treatment (UK Negative result).

V. A total of 9=5% were given up. Of these, 5 died, 4 of pulmonary tuberculosis, Ian meningitis; the remaining 4 are all young people between 16 and 18 years old who have given up the treatment out of indifference.

If we collect this information, we find the following: Of all 187 "small" cases with an illness duration of less than 10 years, 142 were cured, 2 went to their home country for light treatment

passed (later healed), 5 died, 5 interrupted treatment (1 negative. Result), 33 still in treatment.

The reason for the long-term treatment in these 33 cases was: in 6 cases an irregular treatment,

a malignant mucosal disease, 3

serious illness 4

could not find any particular cause

be shown. We have had difficulties to contend with, but in almost all cases we have been able to overcome the skin ailments as such.

20

only

The duration of treatment. It is impossible to give specific information about the required duration. Since only a small area can be treated in each séance, the duration will depend first of all on the spread of the disease, then on the penetration of the disease in depth; the deeper the infiltration, the more time-consuming the treatment. Finally, the duration will often be adversely affected by complications. As we have seen above, e.g. B. obstinate mucosal diseases, from which the disease spreads again and again to the skin, greatly delay healing, sometimes even preventing complete healing; other concomitant diseases, poverty and poor diet will also have an adverse effect and prolong the duration of treatment.

By the way, with regard to the question of the duration of treatment, two things must be separated: 1. the length of time from the beginning of the treatment to the full recovery of the patient, in other words, the time from the first to the last séance and 2. the number of séances. With regard to the first point of view, we must go into the modalities of treatment. The patient is first subjected to a main treatment, after which there is a break so that the treatment reactions can subside and it can be seen whether the main treatment was sufficient or whether follow-up treatment is necessary. In some cases the main treatment is sufficient, but in most one or more follow-up treatments, sometimes an exceedingly large number, are necessary. The treatment can be extended in this way for several years without the number of séances necessarily becoming very large. On the other hand, the number of séances may be comparatively great, and yet the total duration comparatively short, in such cases where the patient has been cured at the first treatment. Each of these relationships must therefore be considered separately. Of course, we can only use the cured patients as material for these examinations. This will result in a significantly more favorable result than is actually the case for the entire material.

Our patient scheme does not give any further information about the number of follow-up treatments; but we found, on examining the ratio from our journals, that 136 patients were cured after the first treatment (main treatment), while the remaining cured cases required one or more follow-up treatments. For each individual patient, what is incidentally common to all conservative treatment methods for lupus and one can probably say to all forms of tuberculosis is that years of careful observation are required before the

, patient can be considered definitively cured.

It is impossible to calculate in advance the number of séances necessary in any particular case. In general, however, it can be said that the number will depend approximately on the spread of the disease, and we must therefore, if we wish to have reasonably reliable information, arrange our cases into groups according to the spread of the disease. In order to be more reliable, we have excluded from our 407 "healed" all those who were treated after January 1, 1901 (a total of 80), the remaining 327 have all been free of recurrence for at least 3/4 years. In the table below we have calculated the average number of séances for these 327 according to each of the four sizes. As in the table on page 16, the patients are divided into 8 groups; in the first column is the total number of cases healed for each 100, then how many cases there are of each spread, with the addition of the average number of séances. The table therefore not only indicates how large the average number of séances was for each individual size, but also how large the number was in the various time periods.

18

158

59

89

108

Of these small cases 21 15 I2 13 20 32

27 Avg. Number of séances | 129 | 87 61

49 59 41 | 34 29

Medium sized

II II II I 2 15 13 IO 6

number of séances

199 | 178 93 102 79 89 57 47

Size

IO 8 6 3 5

number of séances

271 172 146 241 226 113 134 74

spread

5 8 number of séances

470 259 349 380 210 172 171

53

795 6 。

173

2

2

2

2

27

280

In this table, we first notice the big difference in the number of séances for the different sizes. For the total number of "small cases" the average is 59 séances, for "medium" 108, for "large" 173, and for "very extensive" 280. After this we note the significant decrease that occurs in the average numbers from the first hundred to the eighth hundred is present.The table shows that the avg

to

from

average number of séances for "small" cases from 129 to

' has dropped to 29, for 'medium' from 199 to 47, for 'large' from 271 to 74 and for 'very extensive' from 470 to 171.

When we examine more closely what may be the cause of this decrease, we find that it is due to none other than improvement in method or technique. We could certainly rule out all other factors that could come into consideration here. The table shows that the number of cases of each type is approximately equal at the beginning and end, and there is no reason to believe that cases

of the same magnitude have been different at different times. Another objection might seem more plausible, namely that, as mentioned above, we initially used pure light treatment (in the first ca. 130 patients) and later combined it with another treatment which improved the cure. But if we look more closely, it turns out that the combined treatment was mainly used in the large cases, and that the treatment of the "small" cases was almost exclusively limited to pure light treatment (see, by the way, p. 10). Since the falling of the number is just as significant in the "small" cases as in the other sizes, this gives us the right to assert that the combined treatment cannot be the cause. This conclusion is therefore of no small importance in judging the part due to the Light and the other means which we have employed.

So we have no other explanation for the large decrease in the number of séances than the improvement in

well

find method. It is also true here that the greater decrease coincides with the most radical improvements, namely from the first to the third hundred. We have of course been able to prove this improvement in apparatus and lamps purely physically, and our direct experience has also shown us the great practical importance for treatment; but it is only through this table that we have obtained a definite numerical expression of the great progress which has been made. We must remember, however, that the latest average figures may be too favorable, since the longest-treated cases could not be included, but even apart from this the improvement in the method is unmistakable and extraordinarily large.

When we have seen from the foregoing how large a number of séances have been necessary, from the present technical point of view of the method, in order to cure the various cases set forth, it is clear that the total average number is becoming too high. We will only get an exact measure if we consider the last four hundred, and we then find an average of about 40 for "small" cases, about 70 for "medium-sized" about 140 for "big" and for "Very extensive" about 200 séances.

The absolute value of these numbers, as mentioned earlier, is diminished by including only those cases that went well. In this respect there is now a large difference in the various size groups; This statement includes 65% of all "small" cases, 40% of "medium-sized" cases, 30% of "large" cases and only 16% of "very widespread" cases.

For the "small cases" the average number found is 40 séances therefore be approximately correct. The individual numbers from which the average number is drawn vary considerably; we particularly want to emphasize that in 22 cases healing was achieved with very few séances (1-10) of treatment.

The average figures found for the other size groups are of lower value, as they only cover a smaller number of all cases. Mar., on examining the large patient chart, will find numerous cases which have required an extraordinarily large number of séances, and it will be seen that the majority of these have not been included in our presentation, as they were not yet cured.

As a factor which has often lengthened the duration of treatment and increased the number of séances, it must be mentioned that many patients fail to come to follow-up treatment at the right time, thus allowing the disease to spread too much spread; This is especially true for patients who live far away from the institute and who are rarely observed.

For these reasons, as well as many others, one should strive to completely cure the patient at the first treatment. In order to save the patients time and money, we often let them stop the treatment too early and travel home. In recent times, however, we have given up on this and, as far as we can, keep the patients under treatment and close observation for a longer period of time the first time; in the long run this is probably the most economical thing for the patient, and it is also more satisfying for both the patient and the doctor to achieve a cure the first time.

As to the question of judging the value of this method in the treatment of lupus vulgaris, it must be borne in mind that the task set for the method is entirely exceptional. Even the best treatment for any chronic disease cannot be demanded or expected to cure the neglected and most hopeless cases of that disease which have accumulated over a number of years, and that is the task of light treatment been asked and that is what our report is about. On the other hand, to be fair one must judge a method of treatment by its effect on cases which came under treatment before the lapse of too long after the onset of the disease, and this will be done for the Light method when, after a number of years, the old, large cases of lupus are not or hardly ever found. The report on pages 33-34 of all our "small" cases lasting less than 10 years is of no small value in this regard.

As we have seen from the foregoing (Table p. 37), the method has made steady progress in the period here discussed, and therefore the results obtained by us, both for the large and old, and for the small and fresh cases, cannot be regarded as decisive in the determination of the real value of the method.

For this reason, we must conclude by emphasizing that the results which we publish

been possible, with the help of a method which had not yet reached its present full strength, and with a material which was exceptionally difficult, indeed so difficult that

from the outset it must be described as the most difficult test that a healing method can face.

With reference to the large number of new apparatus and lamps which have appeared in recent years, and which are all, as far as we know, weaker than ours, we are obliged to point out that the results depend on the luminous intensity and technique of the depend on treatment. Therefore, if one wishes to obtain the same favorable results as we do, one must use apparatus and lamps of at least the same power as ours; But that's not all, it also requires good burning of the lamps, the most scrupulous keeping of the apparatus and the greatest care on the part of the nurses. Trying to use the method without having studied it in practice will certainly only lead to disappointment.

Patient charts and medical reports

worked out

from

dr H. Forchhammer and Dr. A Reyn.

only

3 sts. 17 8 very spread out,

nose, upper lip,

both cheeks 4W. 34 18 Very spread out,

cheek, neck,

4./5.96

150--110

31./5.99

right

cured. Medical report no. 1:

treatment 1895-96, on the whole

5 months.
Healed *) 1896: UK, 1/22/01.

treatment resumed
7/20/02: No clear ones

symptoms.

Almost healed, 7/10/02: nice

scar tissue on which

Single nodules on the nose.

UK Negative result.

Hopeless case Visible

Improvement.

Healed*). irregular treatment

15./9. 02: No clear ones

symptoms.

Almost healed, 2.7. 02: Good

scar tissue. single knot.

in the edge zone.

Healed*).7.7.02: No German

common disease

Low impact. Again-

raised eruption of deep knots.

right Ear

5 M. 41 22 medium size, nose, nasal cavity 12. 8.96 100 79 28 36 38 1./6.01

upper lip,

both

Wangen 6 W.29 17 Gross, r. cheek

12. 8.96 200 239 223 177.129

1

9 W.19 10 Very expanded, nasal cavity, 19.9.96 470 195 31 7 816.11.01 Healed*). Nice Scar Weight nose, upper lip, gums,

Since 1899 only a few small palate on both cheeks

Node. 3.4. 02: No German

common disease 10W 36 9 medium-sized, nose,

9/19/96 50

14./11.96 UK Missed out. (Oekonoboth cheeks

mix difficulties.) sight.

improvement.
I. 20 7 medium size, nose, nasal cavity 8./10.96 312 162 73 30 31.5.00 Healed*). 31./5. 00: None
Upper lip, 1st cheek

clear signs of illness.

(Not seen later.)
12 f. 16 12 big, 1st cheek, nose höble 19./11.96 100 186 64 5./12.99 UK Missed out. (econo-
neck, r. Foot

mix difficulties.) sight

improvement. 13 sts. 14 2 medium-sized, nose, nasal cavity 28./11.96 80

3/1/97 UK Died 1897 of Te. right cheek

Almost healed. 14/w. 7 5 Small, r. cheek

9/12.96 66 25 16 41 5/11.01 Healed*). 8/22/02: Beautiful

Scar. None clearly. Sick

health symptoms. 15 W. 211 7 small, nose

16. 12.96 98 25

13/6/98 Healed. Medical report no. 2.
16 W.44 40 Gross, I. Cheek

4./1.97
13

22.1.98 UK Died 3/3.98 after

Laparotomy. visible Improvement. 17 W.41 5 small, nose nasal cavity 4./1.97

160 177 24114 64

Temporary improvement.

Persistent breakout from the

nasal mucosa. 8 large, 1st cheek 4./1.97 63 38

almost healed. 11/22/01: Smooth

Varbe with a few nodules. 19 w. 6 2 small, r. cheek

9/13/97 Healed. Medical report no. 3.

tanus.

200

15/1.97 8

18 W.19

200

20 f. 46 7 small, nose nasal cavity 1/16/97 74 47

2 4. 11.01 Healed*). 1.7. 02: Kcine

symptoms of illness. 21 f. 25 u Very expanded, nasal cavity 16./1.97 70

62 50 51

Low impact. (U.N-

nose, upper lip,

regular treatment, sun

both cheeks, forehead,

treatment at home.)

1. ear, throat

22 f. 30 4';, medium-sized, nose nasal cavity 18./1.97 140 134

3/12.98 Healed. Medical report no. 4.

23 m. 20 19 Very spread out,

2/2.97 290 246 147 230 244 26/6.01 UK Negative result.

both obr., cheeks,

Malignant case with low

throat

prospect of healing.

7 large, 1st cheek,

2.2.97 15431

12/1.98 Almost healed. 11/01/03: Smooth

throat

scar weight one more

knots which the patient

not considered.

25 W.13 4. Gross, I. Cheek

3.2.97

471

418.8.01 Healed*). Since May 98: Beautiful

Scar weight, a few small ones

Node. 9. 1.02: No German

common symptoms.

(Tbc. pulm.)

26 M. 50 25 Very spread out,

6./2.97

80

Significantly improved. 1898 1st cheek. upper lip,

until 1902 sun treatment in the 1st ear, throat

home.

10.3. 02: The Be. act again.

24/M. 18

1 20

22

III

27 f. 25 15 medium size, nose, gums, 6/2.97 105 25 – 14 22/12.00 healed*). 12./5. 02: No Cheeks 1901: Hard

clear signs of illness. Palate 28 M. 18 13 Very broad,

2/20/97 90 16 260 230 197

Significantly improved. (Be-

forehead, 1st cheek,

action broken off from 4./6.

ear, neck

97 to 13./12. 98th) 5th/5th 02:

Good scar weight everywhere, only

distributed nodes.

29 M. 33 16 Klein, I. Cheek

8./4.97

UK disease (Tbc. pulm.).

Significant improvement.

30 w. 25 23 medium-sized, nose, nasal cavity 1./4.97 107

11/6/97 Healed. Medical report no. 5.

both cheeks

31 W. 403 Small, nose nasal cavity 1.4.97 90 33

11 12.17.01 Healed*) 1901: Recurrence: Two

small knots. 24./2. 02: None

Disease, 32 W.23 11 Gross, r. ear, Wan

17./4.97 175 307 179 134 107|

partially healed. 4./9.02: Good

Scarring, still deep-looped

Infiltration on the right cheek. 33 W. 47 33 Very spread out,

4.15.97 200 423390 249 135)

Significantly improved. 4th/9th

nose, upper lip, r.

02: Good scarring, ver

some deep knots.

34 W. 23 6'/, small, nose, upper nasal cavity 11.15.97 73

7/9.97 Healed. Medical report no. 6.

lip

35 sts. 6 2 medium, left

15./5.97 95 18 25 48 48

Significantly improved. (Uncheek, upper lip

regular treatment). 22./4. 02: Smooth scar weight, isolated deep nodules.

U.N

44 M. 18 7 medium-sized, nose, nasal cavity, 24./6.97 90 27 9

Almost healed. Since 1899 only one upper lip gum,

a few small nodules on the edge of the palate

of the right nostril.
45 M. 25 / Small, nose

7/6/97 6

13/12/97 Healed. Medical Report No.9. 46 sts. 20 4 small, both ears

17/27/97 54 48

7.17.98 Healed. Medical report no. 10
47 M. 17 7 Very expanded, nasal cavity, 28/8.97 104 304 234 128 21

Low impact. case
Nose,
upper lip, lip., dental

rather hopeless.
both cheeks, forehead fl., palate,

Throat 48W.41 20 large, nose, upper nasal cavity, 31./8.97 98 181 54 53 87

Almost healed. Since 1899 only

lip, both cheeks gorge

divides standing knots, essentially

ly at the edges of the nasal

holes.

49W.49 27 large, nose, upper

2./9.97

27./4.98 UK Illness. No we. lip, both cheeks

kung

50 W.39 29 Gross, nose, both nasal cavities 9:/9.97

(8) 9./5.98 Healed, medical report no. II.

cheeks

51W.39 12 Medium, nose, nasal cavity 15./9.97 89 138 52 51 31

Healed*). Only a few since 1899

Upper lip, 1st cheek

Node. 26./6. 02: No German

common symptoms. 52 W.17 10 Very expanded, nasal cavity, 16/9.97

77 220

20./6.98 UK Died 30./6. 98 on nose, both Wan mouth,

Tbc.pulm. Almost healed. gene, r. poor

Maw,

Throat 53 W. 19 4 medium, nose, nasal cavity 18./9.97 81 140 106

19./9.99 UK Missed out. Almost geupper lip, r. cheek

heals. Later aggravation (Tbc. pulm.).

6649

76

54W.45 33 Very expanded, nasal cavity 26./9.97 82 2731596631

Almost healed. beautiful scar

nose, upper lip,

tissue. Only a few since 1900

both cheeks, forehead,

distributed nodes.

both ears

55 V. 32 20 small, nose, left nasal cavity, 9/27/97 53 14

cured. Medical report no. 12.

cheek

gums

50W.44 28 Very expanded, nasal cavity, 9/29/97 77 260 156 50 28|

Healed*). 21./5. 02: Beautiful

nose, upper lip, gums,

scar tissue. no German

both cheeks, forehead, palate

common symptoms.

both ears

57 W. 33 15 large, r. cheek

9/30/97 48 157

16./8.98 UK Missed out (later

not seen). essentials

Improvement 58 weeks. 21 14 Gross, nose, Wan nasal cavity, 8./10.97

80 147

Partially healed. lips de-

gen, lips

lips,

structured, mouth opening strongly

gums,

narrows, repeated eruption of

palate

the oral mucosa.

Small, nose nasal cavity 9./10.97 45 114 5

5/8.99 Healed. Medical report no. 13.

60 W.23

7 Gross, nose, both nasal cavities 18/10.97 61 293 29 53 13 13/7.01 Healed*). Died June 02

cheeks, eyelid,

(Tbc. pulm.). medical report

right hand, arm

No. 123. 61 M. 12% large, nose, upper nasal cavity, 19./10.97 34 183

14./6.98 UK Died 1899 of tuberculosis lippe, r. cheek gum,

Malignant case with deep sub-

palate

cutaneous and osseous disorders.

66W. 34

22./10.97 43 109 23

48 125

II

*) Table II.

number expansion

of the individual slime and seat light treatments

Result of the skin condition hautlupus

1896

97 TW. 27 8 large, vase, upper nasal cavity 10./11.97 43 305 52 29 68|

Almost healed. Since 1899 smooth lips, both cheeks

Scar weight, only a few small ones

Node. (Tbc. pulm.)
72 M. 20 6 large, nose, both nasal cavities, 10./11.97 43 305 104 40 4./9.01 Healed*). 1901: Small Aus-
Cheeks, 1st ear gums

rupture of the mucosa of
Nose. 18./12. 01: No German

common disease 73 w. 24 17 small, r. Wange, I

11/12/97 15 36 26

4 12./12.01 Healed*). 10th/6th 02: Good temple

Scar. a doubt Node. *7+ M. 19 13 large, nose, upper nasal cavity, 16./11.97 40 280

21./12.98 | cured. Medical report no. 16
lip, both cheeks upper lip,

gums

7 medium-sized, nose, nasal cavity? 2./12.97 25 46 38

I 2.17.99 Healed. Medical report no. 17

both cheeks

Gums 70W. 20 6 large, nose, upper nasal cavity, 4./12.97 23 67

5/4.98 UK Died 1898 of TB.

lip, both cheeks gums,

pulp. low impact.

palate

77 W.44 37 Very expanded, nasal cavity 4./12.97 24 150 76 180 85

Significantly improved. 6th/6th

whole face, neck

02: Standing only slightly distributed

Node.

78 W. 28 14 medium size, nose, gums, 7/12.97 17 223 62 29 – 5/12.00 healed*). Since 1898 is only

upper lip

Palate,

treated the tongue ailment.

Maw,

(Tbc. pulmonary throat, tongue *) Plate III.

79 M. 18 8 Very expanded, nasal cavity, 9./12.97 19 268 254 77 82

Partially healed. lips whole face mouth

are totally destroyed and the throat

case is rather hopeless. (TB.

throat

pulp.)

80W. 26 9 Small, nose nasal cavity 10./12.97 | 19 69 25 3/6.99 Healed. Medical report no. 18

81W. 22

6 Small, nose nasal cavity 10./12.97 | 18 133 32 5/4.99 Healed. Medical report no. 19

82 W.30 14 Gross, nose, upper nasal cavity, 3/1.98 237 178 116189 28/9.01 UK Died. Nov 1901

lip, both cheeks gorge

Cancer.

and ears

83 W.27 15 small, r. hand and

4/1.98 55 4 6 10.12.01 Healed*). 1901: A single

poor

small knot. 30./4. 02:

No clear disease

appearances.

84 W.57 25 Small, nose nasal cavity 5. 1.98

27

4.2.98

Almost healed. Since 1898 only

individual small knots, which

the patient ignores it. 9 Medium, Nose, Nasal Cavity 5/1.98 140 24 15 12/5.00 Healed. Medical report no. 20

both cheeks 86 m. II 3, small, nose

7th/1.98 53 14th

13/6/99 Healed. Medical Report No.21.

*87 M. I 2 large, nose, upper nasal cavity, 1/11/98 230 21 45 19/9.00 Healed. Medical report no. 22

lip, both cheeks upper lip

88 W. 21 5 large, nose, upper nasal height, 12./1.98 118 62 6 8./8.01 Healed*). Since 1899 only one

lip, both cheeks lips,

dubious knot. 10. 2.02:

gums,

No clear disease

palate

appearances.

89 M. 17 5 large, nose, upper nasal cavity, 20./1.98 231 72 83 401

Almost healed.

31.5. 02: Lip only, both cheeks palate

individual distributed small knots.

*) Table IV.

276 138 193 133

60

Almost healed. 9.7. 02: Good

scar tissue, only a few
divides standing knots (Tbc.

pulp.)
Healed*). treatment from 2.2.99

until 9. 7. or cancelled. 1.7.
02: No signs of illness.

ments.

Almost healed. 28/5 02: Only

few distributed knots.

92 sts. 44 4/2 Very spread out,

right ear, cheek and

throat

93 W.21

12 large, 1st cheek,

upper lip

90 W.20

gen, chin

12 Very expanded nasal cavity, 22./1. 98 nose, lips, wan gums,

Maw,

Keble

9 medium-sized, left

24./1. 98

91 W.12

170 13

cheek

24./1. 98

291 289 254 210

31./1.98

183 54 59 14

94 M. 8 8 small, r. Cheek 95 W.29 17 Small, Nose

31./1. 98 nasal cavity 2nd/2nd 98

87 5 8 23. 3. 00 144 11 50 10 1./4. Oi

Temporary improvement.

Repeated eruption deeper

Node.

cured. Medical Report No. 23.

Healed *). Since 5.4. 00: Only

single knots at the edge

of the 1st nostril. 27.7. 02:

No clear disease

appearances.

Partially healed. 2.4. 02:

On the cheek deep infiltration

with distributed standing

Node.

96 W.30 18 large, right obr,

cheek, neck

3rd/2nd 98

264 114157 128

231 32 20./8. 99 Healed*). Died 17./2.

1900 from an ear ailment.

Medical Report No. 124. 56

24.10. 98 Almost healed. Since Oct 98

only 2 small knots which

the patient ignores it.

203 25 31 31 4.9. 01 Healed*). Since Nov 98 only

small wounds in the vestibule. and

single knots on the nasal

hole edge.

196 32 641

Temporary improvement.

(Irregular treatment.)

Repeated outbreak of the

mucous membrane.

7th/8th 99 Healed*) 1902: Small Reci-

div from the mucosa.

136 117 81 28./10.00 Healed*). 14th/5th 02: Smooth

scar tissue, no disease

health symptoms.

129 19 31 23/ 28./10.01 | UK Died 1902 of Morb).

cordis. Since Dec 98 only one

a few small knots.

30./6. 99 Healed. Medical Report No. 24.

106 19

182 15

*97 W.28 17 Gross, nose, both nasal cavities 5.2. 98

cheeks,

Forehead,

Chin 98 W.62 54 Small, r. cheek

10th/2nd 98

99 m. 22

10 small, nose

nasal cavity 11./2. 98

100 W.36

10 small, nose, right nasal cavity 11./2. 98

cheek

101 W.31

5 Small, nose

nasal cavity 15./2. 98

102 M.13

5 small, nose, upper nasal cavity 18./2. 98

lip

103 W.64 10 Medium, both

cheeks, r. Ear

18.2. 98

throat

19./2. 98

*101 W: 22 6 large, nose, upper

lip, both cheeks
105 W. 32 29/4 Small, Nose

Nasal cavity, 21./2, 98
Palate,
maw

*) Plate V, VI.

106 F,16 4 Gross, I. cheek, nasal cavity, 22.2. 98

1899: Nose, Upper Palate, Schl. lip, r. Cheek Throat, 1899:

lip. gums 107 W.21

7 big, nose, b. Wan nasal cavity, 23./2. 98 gen, upper lip

gums,

Palate 108 W.27 12 medium-sized, nose, nasal cavity, 24th/2nd 98

right Ear, Chin, 1st Arm Palate 109 M. 34 26 Gross, 1st Cheek,

26.2. 98 neck

Almost healed. Since Jan 1900

only small wounds and knots

on the nose and mouth. cured. Medical Report No. 25.

10 W.19 5 medium-sized, nose, nasal cavity, 28.2. 98 both cheeks

gums,

throat

from

23./5. 99 Minor exposure. to

continuous depth, infil.
trimmed affect.

1902 the
action resumed.
Almost healed. Since Feb 99

only small outbreaks on the
Nose

the malicious
mucosal disease.
Partially healed. Partially

solid scar tissue around nose
and mouth repeated ex-

fracture. Tbc.pulm.

Temporary improvement.

Repeated outbreak.

essential improved. Again-

outbreak v, i.e. nasal cavity.

1 M. 23 12 Very spread out, nasal cavity, 2nd/3rd 98

Nose, lips, Wan lips

259181 205 103

gen, neck

112 M.18

197101 217157

4 small, nose, upper nasal cavity, 5./3. 98 lip

Palate 6 small, nose, right nasal cavity, 6.3. 98

gums,

113 W.30

156 5081 38

cheek

114 W.52

217137 48

27/9 00

115 W. 31

Small, nose, right nasal cavity 7th/3rd 98

cheek
4 large, nose, right nasal cavity, 10./3. 98

cheek, upper lip, throat
1900: 1st cheek

66 --- 1185 18 2nd/9th Oi

UK Negative result.

Low impact.

Divided*). Canceled from

27.5.98-5. 5. 1900 due

from Tbc.pulm. 5.4. 02

Letter: No illness.

Almost healed. Since Dec 98

only distributed nodes.

cured. Medical Report No. 26.

131 30

6.4. 99

2

10 medium-sized, nose, nasal cavity 14./3. 98

right cheek, upper lip

Medium-sized, nose, nasal cavity 16./3. 98

right cheek, upper lip,

throat

Medium-sized, nose, nasal cavity, 16th/3rd cent. 98

right cheek, upper lip gums

168 151 129241

Almost healed. Since June 1900

only single knots at Na.

senlochrand.

189 56 22 46 21./9. 01 Healed*). Since 9.1.99 only

few small knots. 14 4

02: No symptoms

ments.

235 52 181140

Partially healed. Partially

solid scar tissue,

hard.

stubborn affect to nose and

Mouth. Tbc.pulm.

185 61 43 65

Partially healed.

Partially

solid scar tissue on which

1. Cheek a single batch

with deep knots.

126 45 28 141

Significantly improved. As.

repeated outbreak of the

mucous membrane, irregular

Treatment. Tbc.pulm.

5 Very spread out, nasal cavity, 17th/3rd cent. 98

nose, upper lip, upper lip,
both cheeks, neck gums,

palate
8 Large, both walls

19./3. 98

gen, neck

117 W.21

118 W. 15

119 W. 20

I 20

m 20

I 21 W.18

I 22 W. 16

5 Small, nose

nasal cavity 19./3. 98

218147 8991

125 M. 43 12 large, nose, upper nasal cavity, 22./3. 98 lip, both cheeks upper lip,

gums,

Palate 126 M. 21' 19 Very expanded, nasal cavity, 23./3. 98

whole face, both gums,
ears, neck

Palate,
throat

Partially healed. Partially

solid scar tissue,
eruptions from the nasal

cave.

Almost gecilt. strongly destructive

th case with almost total blindness

Ness. 7/23/02: Solid Nar-

tissue, only in the lip

pen small wounds.

11./3. 99 UK Died 28. 3. 99 at

Tbc. miliary.

207 214151 58

127 m. 23

220 49

7 large, nose, both nasal cavities, 25./3. 98 lips, r. cheek lips,

gum

men gullet

Tongue 3 Small, I. Cheek

4th/4th 98

204 22 52

123 M. '16 14 large, nose, both nasal cavities 21./3. 98

cheeks, upper lip,

neck, r. poor

*124 M. 17 4 medium-sized, nose, nasal cavity, 22./3. 98
right cheek

Palate,
Maw,
throat

1/5.00 Almost healed. 7/23/02: Solid

scar tissue, only on the

Jibe single small knots. 22./8. 98 Healed. Medical Report No. 27.

I 26

128W

4

571

2.7. 98 | cured. Medical Report No. 28.

*) Table VII.

29./6.

02:

129 W. 2016 Very expanded, nasal cavity, 13./4. 98

Upper lip, gums, both cheeks, chin, palate

Neck 130W. 32 12 medium-sized, nose, nasal cavity 16./4. 98

both

cheeks

131 W.65 10 Very expanded, nasal cavity, 18th/4th cent. 98

upper lip, palate

both cheeks
132 W. 14 4 small, nose, upper nasal cavity 22./4. 98

198 30 54

Healed*). 27./1. 02: Solid

scar tissue, very single small knots,

No illness 78 26 49 12

Almost healed. 29./8. 02: nose,

right Cheek free, 1st cheek two

small knots. 165 27 23 14 23./7. OJ Healed*). Since 17./10. 98 only

few distributed stand. knot. 10.5.

02 Letter: K. Illness. 105 35 5259

Almost healed. Slow cont

crotch, stubborn mucosal affect. 14:7 02 : Individuals

small.knot at the edge of the nostril. 189114

6.17. 99 Healed. Medical Report No. 29.

right

*133 M. 20 II Very spread out, nasal cavity, 28./4. 98

nose, lips, both lips,
cheeks,

ell gums,

arch, I. Thigh Palate 134 M. 14 / Small, I. Cheek

3rd/5th 98

135 W. 25 11 medium-sized, nose, nasal cavity, 4th/5th 98
both cheeks

gum
men gullet

throat
136W. 21 3 small, nose nasal cavity 10./5. 98

Healed*). 21.17. 02: None

symptoms.

Healed*). Since 4./11. 98 only

few distributed knots.

6/22/02: No illness

appearances. Healed*). Since 31.5. 99 just a nodule. 5/3/02:

:: No signs of illness.

Nose,

upper lip,

lip

Nose,

*) Table VIII.

Partially healed. 1900: New

malignant affection of the
lip. 20./1. 02: Almost everywhere
scar tissue. Still wounds
on the lower lip, as well

single knots.
Temporary improvement.

Repeated outbreak of
the malignant mucosal
Suffer.

168 150 84 36

Almost healed. malignant case,

total destruction of the lips.
23./8. 02: Good scar
weave, few doubtful ones
Knots, mucous membranes still

ulcerated.

86 44 68 11 28./5.01 Healed*). Since 31./1. 99 only

small eruptions of the hard

stubborn ailments in the nasal

cave.

131

29/10 98 Healed. Medical report no. 30

!

* 141 W. 30 15 Very expanded, nasal cavity 1st/6th. 98

Nose, upper lip, both cheeks

*) Plates IX and X.

142 W.13

4 small, l. cheek

2nd/6th 98

26 7 30 6

Temporary improvement.

irregular treatment.

Repeated small recurrences.
2nd/11th 98 Healed. Medical report no. 31

132

*143 W. 43 19 medium-sized, nose, nasal cavity 2nd/6th 98

both cheeks, Ober

lip
147W.62 8 medium-sized, nose, nasal cavity 3.6. 98

right cheek, r. hand
145W. 39 8 small, nose, both nasal cavities 3rd/6th 98

cheeks

140 W. 50 10

Medium sized, left

temple

11th/6th 98

72 51

Healed*). 1900-1901 suns

treatment at home. 30./6.02

Letter: No illness.

16./12. 99 VK Negative result.

Only temporary improvement.

Affect. very heavily pigmented.

12./8. 98 Healed. Medical report no. 33

Almost healed. Good since 1901

scar tissue, few

Node.

6th/1, 00

147 W. 8 small, l. Cheek.

15th/6th 98
148 W. 35 6 large, nose, upper nasal cavity, 18th/6th 98
lip, both cheeks upper lip,

Zinc Meat,

throat
*149 M. 14
7 Very spread out, nasal cavity, 20./6. 98

upper lip,
both cheeks, neck gums,

Palate,
Maw,

throat
* 150 W. 305 Large, nose, upper nasal cavity, 21./6. 98

lip, both cheeks gums,

palate

Nose,

139 57

2014 5/11, 01

Healed*). Only one since 1899

obstinate wound in the 1st Vestibulum and foremost nostril
nod 8.7.02 k. disease

*) Plates XI, XII and XIII.

only

131 106123 27 20.10. 01 Almost healed. Since 11./7. 00

solid scar tissue, few distributed nodes. 8th/7th 02: Single ver

divides standing nodes. 108 40 29./6. 00 UK Missed. before

temporary improvement. U.N

regular treatment.
126 8

10th/1st 99 Healed. Medical Report No.34.

57 22

2 13./8. 01 Almost healed. Since 30./4. 99

only individual distributed standing
Node. 6th/9th 02: A small one

Node.
28./7. 98 | cured. Medical report no. 37

157 W. 34 16 Very extended, nasal cavity, 28./6. 98

Nose,

Upper lip, throat both cheeks

158 W. 3124 large, 1st cheek,

28/6 98
right Ear, I. Arm and

hand
159 W.18 10 medium-sized, nose, nasal cavity 29./6. 98

1. Cheek
160 W. 28 9 large, nose, upper nasal cavity, 1st/7th 98

lip, both cheeks, upper lip,
right upper eyelid gums,

throat

161 W. 60 0 45

Gross, nose, both nasal cavities 2.17. 98

cheeks

162 W. 27 8 small, nose nasal cavity 5.17. 98 163 W. 17 2', small, nose, left

5th/7th 98 Cheek, I. Eyes

brew, r. Arm 164 W. 24 6 Small, Nose, Left nasal cavity, 5:17. 98

gums

cheek

165 W.1915

Small, 1st cheek

6.7. 98

166 W. 50 16 Very expanded, vase cavity, 7.17. 98 whole face

lips

80 98

167

99

31''/small, nose, upper nose bole 8./7. 98

lip
1

168

,, 24 19 medium size, left nasal cavity 7/11/98

Cheek, I. Arm

20./11. 99 UK failed (eco.

mixed reasons), essentially ge

improves (Tbc. pulm.).
93 23 25 5 23./3. Oi gecilt*). Repeated small

Outbreaks from the slime
skin. 7.6. 02: No sick.

health symptoms.

64

13th/10th 98 UK Missed out (way.

travel). Almost healed. 10/24

02: Only one on the cheek

Node.

13127 67 18./9. 01 Healed*). Repeated small

Outbursts from the mucus

skin. 7./5.02: No sick

symptoms (Tbc. pulm.).

79

13th/6th 00 healed. Medical report no. 38

169

22

9 medium-sized, nose, nasal cavity, 18.17. 98

both cheeks, upper throat,

lip

throat

170

26

171

251 12

26 10

big, 1st cheek,

23./7. 98

throat

Small, nose, upper nasal cavity 27.7. 98

lip

281 15 large vase, top

29./7. 98

lip, both cheeks

26./10. 98 Healed. Medical Report No.39.

172

53 52 | 28

Healed*). 15.7. 02: Good

Scar tissue, some small
Node. 29.9. 02 letter:
No symptoms of illness.

174

36 6', large, nose, upper nasal cavity 9./8. 98

lip, both cheeks,

right temple
175 M. 44 3', large, nose, upper nasal cavity 9. 8. 98

lip, both cheeks

Messages from Finsen's medical light institute.

124 33

8th/2nd 99 Healed*). Died 13./10.99

of TB miliaris. suffer

report no. 129. 133 75 29.4. 99 UK Died 27./9. 99 on

morb. cordis. low one

effect 1 22 36 617./7.01 Almost healed. Since 12./12. 98

only a few, spread out
Node. Very fond of Tbe. pulp.
suffering. 7.15. C2 letter: Zu-

peace with the result.
122 118 110 68

Almost healed.

5th/9th 02: Solid scar tissue, 3 doubts

tacky knots. 53 - 74 26

Almost healed. 1900 pretty big

relapse. Since 13./10. ooh only
single knots at the

right nostril rim.
1 24 16 170 30

Almost healed. Since Sept 00

only a few, spread out

Node. 27

13./9. 98 Healed. Medical Report No.40.

181 w.37

Almost healed. malignant case,

grew in the first time despite
Treatment. 24./8. 02: Good
scar tissue, few
Node. at the nostrils
border small wounds. (TB.

pulp.)
Low impact. Size

Destruction of the lips and
enormous infiltration, only slight
prospect of full recovery

lung.
Partially healed. repeated

eruption from the nasal cavity.
Partially healed. 23./11. 00:

Head and neck apparently healed, extremities doing well 189 w. 266 Very spread, cheeks, chin, neck

6.9. 98

192 W. 164

small, nose

Nasal cavity 8.9. 98

53 50 48 19

Almost healed. Irregular

Treatment. 8/15/02: Good
Scar tissue, some small

Node.
100 258 - 19./11. 99 UK Died 21./12. 99

of tuberculosis pulm. low one

effect

26

17 22./9. 00 healed. Medical report no.

44. (Tbc. pulm.)

79 2 23 19./12. 00 Healed*). Since 6./12. 98 only

single small knots. 29.5.

02: No significant sickness.

health symptoms.

31 19 - 17 3./8. 01 UK Negative result.

Irregular treatment niit

temporary improvement. 99 11

14th/1st 99 UK Died in spring

99 to tuberculosis pulm. minor

impact

94 107 66 63

Almost healed. Irregular

Treatment. 18.6. 02: Only
a few on the nostrils
small wounds and knots.

--

Large, nose, upper nasal cavity, 6.9. 98 lip, 1st cheek

throat

195 W. 45 12 medium size, nose, nasal cavity 12.19. 98

upper lip, both
cheeks, neck

92 209

Almost healed. treatment from

12.8. 99 to 8./3. oi off

broken. 31.17. 02 : Good

scar tissue, few,

distributed nodes.

65 206 104 610.17.01 | Healed*). 20.7. 01: None

clear signs of illness

ments; not seen later. 81 236 81130

Almost healed. 18th/6th 02: Good

Scar tissue, none distinct

knots, single doubtful

Stains. (Tbc, lung.)

26./11. 98 Healed. Medical Report No.45.

198 W.29 15 Very expanded, nasal cavity, 14.9. 98

nose, lips, both gums,

cheeks, chin, neck

45 35 Very expanded, nasal cavity 20. 9. 98

ise, upper lip

both cheeks, chin,

right amm

200 37 18 medium-sized, nose, nasal cavity 26. 9. 98

both cheeks

Small, nose, upper nasal cavity 26. 9. 98

lip

22 14 79 – 14.11. 98 Healed*). 18th/6th 02: None

symptoms. (TB.

pulm.) 80 127 129 98

Significantly improved. bad

like mucosal disease, like-

repeated outbreak on the

Skin.

27

5th/11th 98 UK Died Sept 99.

Complicated case with ulcus cancros nasi.

203

71

9th/1st 99 Healed. Medical Report No. 46.

24./10. 98 UK Missed. 50 43 75 57

Almost healed. Malicious case

with repeated outbreaks.

Tbc.pulm. 1.17. 02: Only

a few on the upper lip

nodules.

63

17th/12th 98 UK Died Summer 99.

treatment for acute. tuberculosis

pulp. canceled. 59 185 62 - 5th/9th 00 Healed*). 22./10. 02: Solid

scar tissue, no disease

health symptoms.

54 62 46 64

Significantly improved. depth

lupous infiltration, slower

Progress.

56 22 26./1. 99 Secret medical report no. 47

(Tbc. pulm.).

55 195 62 206

Almost healed. Irregular

Treatment. 5th/8th 02: Good

scar tissue, few, distributed

standing nodes (Tbc. pulm.)

72 309 245 270

Healed (concerning face),

Medical report no. 48

2 medium-sized, nose, nasal cavity, 26.10. 98

Upper lip, 1st cheek Gums 23 5 Very spread out, nasal cavity, 10/28/98

Nose, upper lip, gums both cheeks, 1.

upper arm

*212 29 13 Very widespread, nasal cavity, 29th/10th 98 both cheeks, forehead, gums,

neck, both upper throat

extremities

213 M. 20 8 medium size, nose, nasal cavity 1. 11. 98

upper lip, both

Wangen *) Plates XV and XVI.

16th/3rd 99 Healed. Medical Report No.49.

214 W.'15

26 122438 329

2 Very spread out, nasal cavity, 1st/11th cent. 98

Whole face, body, palate, per, extremities

Keble

Low impact. hope

no case, lost everywhere

spread affect.; the suffering

spreads despite treatment.

Almost healed. 9th/6th 02: Only

few, distributed knots.

215 M. 37, 10 Very spread out, nasal cavity, 2nd/11th 98

nose, upper lip, palate

both cheeks, both

ears, neck

216 W.38 23 Very spread out,

2nd/11th 98

nose, right Cheek,

Forehead, neck, left

arm and foot

217, 41 13 large, nose, upper nasal cavity, 7th/11th 98 lip, both cheeks upper lip,

gums,

palate

12./12. 2. 99U. K disease. evident

improvement

218 M. 34 20 large, nose, upper nasal cavity, 8th/11th 98

lip, 1st cheek, r. upper lip,
drum

gums,
Palate,
maw

219/W.21

46 22 40 40

7 Very spread, gums 8th/11th 98

1. Cheek, chin, neck

Healed*). Since January 99 only
few, distributed knots.
21./7. 02: Good scar
weave. No sick people.

appearances.
Almost healed. 2/4/02: Solid

Scar tissue, some small
Node.

220

46 179 39 39

, 36 28 Very expanded, nasal cavity, 8th/11th cent. 98

nose, upper lip lips both cheeks, chin,

Neck, I. thigh 3 large, nose, upper nasal cavity 8./11. 98

lip, both cheeks

221

1

20

46 121 67 95

222

42 259 172 156

Almost healed. 6/5/02: Solid

Scar tissue, just a doubt

sticky knot.

Significantly improved. Long.

same progress.

6.9. 02:

Distributed nodes only.

Low impact. hope

unaffected case with severe destruction and deep lupus infiltration.

14 14 Very spread out,

11/11 98 1. Ear, cheek, forehead,

neck, 1st thigh

223 M. 21 n Very spread out, nasal cavity, 14th/11th 98

nose, lips, both lips,

cheeks, chin

gums,

Palate,

Tongue

224W.30 16 medium-sized, nose, nasal cavity 14th/11th 98

Upper lip, 1st cheek

Almost healed. Since March 99

only a few distributed standing

Node. 7.4. 02: Good

Scar tissue, only on Prolab.

great a small wound. 15./3. 99 Healed. Medical Report No.51.

*225

24 _

41 60

-

5 medium-sized, nose, nasal cavity 14th/11th 98 upper lip

Gums *) Plate XVII.

UK stayed away. essence

slightly improved. treatment off
economic reasons

broken.
Almost healed. Irregular

Treatment. 11.3. 02: Good
scar tissue, some fresh

Node.
cured. Medical report no. 52

(Tbc. pulm.).

» 39 22

29 117 28

6.9. 00

228

Very expanded, nasal cavity 28./11.98

nose, upper lip,

both cheeks
229 M. 18 2"), small, nose, upper nasal cavity, 28./11. 98
lip

gums

26163

230 W. 41 25 Very expanded, nasal cavity, 1st/12th 98

Nose, upper lip, upper lip both cheeks, forehead

2940

13./2. 99 UK Stayed out without

give reason. Significant

improved; later aggravated.

8th/11th 99 Almost healed. From econo.

mix reasons canceled.

13./2.02: Good scar tissue,

wherein a part distributed nodes.

25 71 30 109

Almost healed. Irregular

Treatment. 19.8. 02: Only

single knots.

25 141 82 17

Almost healed. Good since 1900

scar tissue, only on the

Nose small recurrent

wounds. (Tbc. pulm.)

231 65 20 large, nose, upper nasal cavity 2nd/12th 98

lip, both cheeks,

upper eyelid

232 M. 48 14 medium-sized, nose, nasal cavity 2nd/12th 98

right cheek

I

25 332 83

233 W.27 20 Very spread out,

2nd/12th 98 r. hand and arm,

1st leg 21 16 large, nose, upper nasal cavity, 3rd/12th 98

lip, both. Cheeks, gums, 1st ear

palate

2341 »

24 100 68 591

3.9. 00 Healed*). 2nd/4th 02: Good

Scar tissue, none distinct

symptoms.
Almost healed. spring 1902

Tbc. pulm., simultaneous
fracture of a part fresher

Node.
4th/2nd 99 Healed. Medical Report No.53.

Almost healed. 19.9. 02: Good

scar tissue, few,

distributed standing nodules.

22 30

15 192 206 310

only

18 122106

235 sts. 23 15 medium, neck

5th/12th 98

236W.38 31 Large, nose, upper nasal cavity 5th/12th 98

lip, both. cheeks,

upper eyelid, r.

ear, neck

237 M. 27 13 Very spread out, nasal cavity 10th/12th 98

nose, upper lip,

both cheeks, neck

238 18 10 small, nose nasal cavity, 12./12.98

upper lip,

gums,

palate

* 239 W. 16 2', Very expanded, nasal cavity, 12/15/98

whole face, neck lips,

Zinc Meat,

palate

20 5 medium-sized, nose, nasal cavity 15.12. 98

Upper lip, 1st cheek

19./12.00 Healed*). 17th/12th 01: None

clear signs of illness

ments.

12.3. 99 Healed. Medical Report No.54.

Almost healed. Since April 1900

good scar tissue, just a-

individual, distributed nodes

(Tbc. pulm.).

Almost healed. Since 1899 only

a persistent wound in and

at the left corner of the mouth.

249

.

13 113 48 78

*) Plate XVIII.

94 - 24./4. 99 Healed *). Died July 1900

to Thc. pulp. medical

judge no. 130

69 13 4 30./8. 01 Healed *). Since March 1899

only a few knots. 30./4. 02

Letter: No disease

appearances.

97 2 41

Healed*). Dec 1900: Small

Recurrence since 1"), years, 3./7.

02: No significant disease

health symptoms.

*) Plate XIX

11./7. 99 | cured. Medical Report No. 57. 313 2 1 2 268

Significantly improved.

Heavy case with deep infiltration. I 2. 10. 02 Obs.:

Good scar formation, still

divides standing nodes.

45

11./3. 99 Healed. Medical Report No.58.

50

11./3. 99 | UK stayed away. essence

slightly improved. 4./12.00 letter:

Still remnants of the affection.

Nothing born later.

1 29 23 17) 12./7.01 Healed*). Since May 99 only

few knots. 10th/12th 01 Letter: No symptoms of illness.

Palate,

cheeks

*250 , 34 4

Nose, lips, both lips
cheeks, chin, neck,
right upper and lower

extremity
* 252 6 3 Small, I. Cheek

whole face, r. ear, 1st elbow

.

256 W. 36 4

Upper lip, 1st cheek

*) Taiel, XX, XXI.

257 v. 44 10

Large, nose, both nasal cavities 19.1. 99 85

cheeks

Almost healed. Since April 99

only single, distributed standing
Node. 1.8. 02: Good
scar tissue, two hemp seeds

big wounds.
cured. Medical Report No.59.

9th/5th 99

258 M. 39 25 large, both cheeks,

24./1. 99 62 r. ear and upper

eyelid, neck 259 4/12 small, r. cheek

1/25/99 8
260 W. 2623 Very spread out,

1st/2nd 99 75

right arm and foot

261 M. 57 15 medium-sized, nose, nasal cavity, 1st/2nd, 99 51 18

9

upper lip, both palate

cheeks

262 W.17 8 large, nose, upper nasal cavity, 1st/2nd 99 178 101 28

lip, left cheek, lips,

both upper eyes-gums,

lid, neck

palate

263 m. 17 12 Very spread out, nasal cavity, 1st/2nd 99 180 76 34

whole face, r.

lips, hand and foot gums,

palate

2.2. 99

140

10

265, 25 2:2 medium size, nose, nasal cavity, upper lip, both gums,

palate

13.4. 99 Healed*).

4. 1. 00

Letter:

No signs of illness.

Not seen later.

20./11.00 Almost healed. Since July 99 only

single small knots. 20.10.

02: Beautiful scar tissue ;

5 small knots in all.

19./5. 99 Healed. Medical report no. 61

cheeks

270

Medium sized, left

cheek

very spread out,

nose, upper lip,

both cheeks, left.

poor

44 11

14. 2. 99191

5351

from

*) Plate XXII. 65

273 M.IT

18

Healed*). Original Af.

fect. healed, on prolabium
great now and then fissures and
small wounds. 10/01/02:
No clear disease

appearances.
Almost healed. absent

11.4. 99 to 2.8. 1901 on
cause of eye disease. II 4.
02 only a few, spread out

Node. 11./5. 99 Healed. Medical Report No.62.

Medium size, nose, nasal cavity, 16. 2. 99 both cheeks.

palate

2

Significantly improved. U.N

regular treatment. As

repeated eruption of deep nodes. 23./6. 99 Healed. Medical Report No.63.

*276 M. 40 9

277

39 8

II

Medium-sized, nose, nasal cavity 20./2. 99 105

throat

Very spread out, nasal cavity, 22./2. 99 259 51

Nose, both cheeks, palate

Forehead

Small, nose, right nasal cavity 24.2. 99 37

9W: Vange

278 W. 20

Almost healed. Since August

99 only a few, spread out

Node.

Healed*). 6.11. 1902 letter :

No signs of illness. gene,

2

5 27.17. 01

---

*) Plate XXIII.

279 W. 26 3

Small, nose, right

nasal cavity

27th, 2nd 99th

82

41

86

cheek

280

" 17

80

small, nose 1901: nasal cavity, 27./2. 99 102
upper lip, r. cheek palate,

1901: Throat
„ 45 4 medium-sized, nose, nasal cavity 3rd/3rd 99 77

upper lip, both

281

26

Healed*). Since 1900 only on

Small wounds at the edge of the nostrils. 18.7. 02: No disease

appearances. 25 10.8. 01 UK Died Dec 1901.

Almost healed. O1: tuberculosis pulm.,

at the same time small outbreak.
8 4.3. 01 UK stayed away for economic reasons. almost
heals, since June 99 only a few,

distributed nodes.
7.17. 99

UK disease.

heals. 10th/4th 02 Letter: Good

scar tissue, still some

Node.

26./6. 99 Healed. Medical Report No.64.

cheeks

almost ge

11. 3. 99 234 205 146

UK Missed out (paupe

rism). Significantly improved.

nasal cavity

20. 3. 99 146

286

, 39 27 medium size, left

24.3. 99 114

cheek

287

Almost healed. Since January 1900:

Good scar tissue, just we

few, distributed nodes. Almost healed. 7/13/1902:

Individual dubious nodules, which the patient ignores,

In the interim. Improvement.

2 times recurrence in acute illness

heit (pauperism).
Significantly improved. evil

nice case. Barely a view
for healing.

4/6/99

214 265 266

Nose,

* 290

38

289 '28 13 Very spread out, vase cavity,

upper lip, upper lip,
both cheeks

gums,
Palate,

maw
4 Very spread out, vase cavity,
whole face

upper lip,
gums,

palate

291 M. 46 20 Large, Vase, Upper Vase Cave

lip, both cheeks, !

1. ear

292

25 13 large, r. cheek

7th, 4th 99

88 107

84

Healed*). Since Oct. 1899 only

few knots.

August 10, 1902

Letter : No disease

appearances.

Significantly improved. Long-

same progress. Deep infiltration distributed with outbreak

standing knot. UK Died. 2.5. 1900

Almost healed. Tbc.pulm. and larynx.

f. 33 19 Very expanded, nasal cavity 294

10.4. 99 73 88 37

Almost healed. Since April 1900: nose, both cheeks,

Good scar tissue, only we1. poor

few, distributed nodes

(Tbc. pulm.). 295 66 15 medium-sized, nose, nasal cavity, 11.4. 99 75

29.7. 99 Healed. Medical Report No.65. upper lip, both upper lip nasal cavity 12./4. 99 53 24

18 4th/6th 01 Healed*). Since July 1899 only

a small wound on the nose
hole edge. 28/5 1902: None

symptoms.
297 - 45 24 Very spread out,

12./4. 99 222 336 125

Significantly improved. 5th/7th whole face, r.

1902: Good scar tissue, ear, neck

a part distributed standing knots. 298 M. 20 6 small, nose, upper nasal cavity, 14./4. 99

23 12./12. 01 Healed*). 18th/6th 1902: No lip gums,

symptoms. 299 W.43 30 medium-sized, nose, nasal cavity 15. 4. 99 54

9

Healed*). 22./4. 1902: Face
upper lip, r, cheek,

free, under the chin 2 small

throat

Node. 3rd/9th 1902: None

symptoms. 300 , 30 15 medium size, both nasal cavities 17. 4. 99 55

1st/7th 99 Almost healed. later only one

cheeks, neck

individual little knots, which ones

at home in a different way

are treated.

301 58 35 Very expanded, nasal cavity 18. 4. 99 | 186 139 62

Significantly improved. evil

upper lip,

type case with deep infiltration. W both cheeks, neck,

March 12, 1902: Overall good scar tissue, some with distributed lumps.

cheeks

296 , 33 10 Small, nose

c.

Nose,

right Foot

Almost healed. 13th/6th 1902: Im

face good scar tissue,

individual nodes on which ex

standing in tremors

nodes (Tbc. pulm.).

25/10.99 Healed. Medical Report No.66.

302 F. 18 16 Very expanded, nasal cavity, 20.4. 99 209 297 262

nose, lips, both gums,

Cheeks, throat, both palate

upper extremities, 1.

Nates

303 59 16 medium-sized, nose, nasal cavity 21./4. 99 154

both cheeks

304 M. 24 2 Very spread out, nasal cavity 22./4. 99 142 73 15

Nose,). Cheek,

right upper eyelid,

neck, both hands

305 W. 33 5 Small, Nose

Nasal cavity 24. 4. 99 39 97 93

306 , 31 6 Small, Nose, Upper nasal cavity

lip

24./4. 99

30

3 22

Almost healed. April 29, 1902:

Partly solid scar tissue,
only on the nose and the

hands separate knots.
Low impact. Hard.

persistent ailment in the nasal
cavity and at the nostrils

edge.
Jointed*). persistent. Mucus-

skin condition. 14th/7th 1902: None

symptoms.
Significantly improved. evil

kind of suffering

with big

wound surfaces. June 23, 1902:

Good scarring everywhere,

only distributed nodes

(Tbc. pulm.).

7.17. 01

307

, 14 3 Very expanded, nasal cavity, 24./4. 99 148 151 158

nose, lips, both lips,

cheeks, chin, neck gums,

palate

308 W.18

5 medium-sized, nose, nasal cavity, 24./4. 99

Upper lip, both gums, cheeks

Maw,

throat

4 small, r. poor

25./4. 99

2 small, nose, upper nasal cavity 26./4. 99

lip, r. cheek

309

4

310 m. 13

36

40

53

311 w.35)

Very expanded, nasal cavity, 26./4. 99 181 114 198

whole face, 1st gum, ear, neck, all

4

palate
extremities

312

92 40

9

„ 17 12 medium-sized, lips, nasal cavity, 27./4. 99
both cheeks

upper lip,
gums

25./4. 99 Healed. Medical Report No.68.

Significantly improved. U.N

regular treatment,

persistent ailment in the nasal

cave.
Partially healed. Good scars.

education, face free, on the
extremities quite numerous,
distributed standing nodes (Tbc.

pulp.).
Almost healed. stubborn

mucosal disease with again.
caught small outbreaks

(Tbc. pulm.).
Almost healed. stubborn

mucosal disease with again

caught small outbreaks,
Significantly improved. evil

nice case, coherent
deep infiltration. 9th/5th 1902:
Good scar formation with

splits standing knot.
18.4. 00 UK stayed away due to economic reasons, essential
improved.

313

, 29

6 Small, nose

nasal cavity, 27./4. 99
gums,

30 46 50

316 W. 65' 34 large, vase, upper nasal cavity,

lip, both cheeks throat

3. 5. 99

42 1245

Significantly improved. U.N

regular treatment (tbc.
pulp.). 18./3. 1903: Only we.

few knots.
127 157 141

Low impact. bad

similar case, has spread despite treatment. 9th/1st

1902: Partial scarring. 132

Healed*). 6/3/1902: Over

all good scarring, just up

right cheek a pea-

big knot.

30

8/28/99 Healed. Medical Report No.69.

15

8th

Almost healed. malicious. mucus

skin ailments with repeated

small outbreaks. 96 88

Significantly improved. Be.

action from 27., 11. 1900 to

Broken down September 9, 1902. 10.7. 99 Healed. Medical Report No.70. 91 18 8 24.;6. 01 Healed*). 4/21/02 Letter: None

symptoms.

322

19

I

38

Small, nose, upper lip. nasal cavity 36 22 medium-sized, nose,

upper lip

11th, 5th 99th 12th, 5th 99th

323

324 m. 23 19

big, 1st cheek,

throat

13./5.99

52

noir

14/5.00 Almost healed. 6th/11th 00: Good

scar tissue, few

Knots which are not considered.
29.17.99 UK Died July oo on

Tbc.pulm. Almost healed.
Significantly improved. together

men-hanging suffering with deeper
infiltration and scar traction.
1.17. 02: Good scar formation

with distributed nodes.
20/10/99 Healed. Medical Report No.71.

Almost healed. Since oo: Good

scarring, few

Node.

Almost healed. 3rd/5th 02: Good

scar tissue, few

small knots.

26/10.00 UK Died of tuberculosis pulm.

Significant improvement.

2

8th

I 21

48

27

only

small, nose

Medium sized, right

cheek, ear, neck,

1. Thigh
very spread out,
whole face, l.

ear, neck
Very spread out

whole face, neck

12

18./5.99 189 320 299

only

nasal cavity

20./5.99 183 113

327 W.31

328 W. 18

329 W.27

330 m. 24 17

*331 W.18

333 W.41

27./5.99

77

16

13

6 Medium size, nose, nasal cavity, 1st cheek

gums,

palate
6 Small, nose

nasal cavity

335 W. 6 1/2 small, nose 336 W. 21

7 Big, nose, upper nasal cavity

lip, both cheeks

29./5.99
30./5.99 188 119

Almost healed. Since Aug 99 only

individual, distributed knots

ten.
Healed*). 19.4. 02: Small

recurrence of the mucous membrane.
19. 8. 02 Letter: No sick

health symptoms.
1st/10.00 Healed. Medical Report No. 73.

Healed*). 01: light treatment

in Berlin. 1.1. 02: None

symptoms.
27 | 15./10.01 Healed*). 17.6. 02: None

symptoms.
24 7./7.01 Healed*). 20.4.02 Letter: None

symptoms.

Nose,

337 W.57 20 medium-sized, nose, nasal cavity

right Cheek, forehead 338 W. 41 12

Very expanded, nasal cavity,

upper lip, gums

both cheeks
339 W.41 20 Very expanded, nasal cavity

upper lip,

both cheeks 340 W. 55 30 Very spread out, nasal cavity,

whole face, neck gums

2./6.99

Nose,

94 154 20./10.00 UK Missed out. (Eco

nomic reasons.) Obvious

Improvement. (Tbc. pulm.) 181 262 186 9./5.01 UK Negative result.

Hopeless case, only lesser
Progress.

3./6.99

very spread out,

both cheeks, T

Ear

small, nose

nasal cavity

8 32

6 Medium-sized, nose, nasal cavity

upper lip, b. cheeks

345W.708

7th/6.99 154th

25./8.99 Significantly improved. Puts

the light treatment in London

away.

7./6.99

36

Almost healed. malicious. mucus

suffering from skin, with wounds on

nostril rim. (Tbc. pulm.) 8./6.99 71 128 103

Low impact. bad

nice case with constantly new ones
localizations and osseous

affections.
9/6/99 53 27 32 11/9/01 Healed *). Repeated small

Eruptions from the nasal cavity. 4/29/02 Letter: None sick.

health symptoms. 6/10/99 91 70 32

partially healed. Partly good

scar tissue, on the nose
repeated small outbursts.

(Tbc. pulm.)
6/14/99 26
43 22 14./12.01 Healed*). Since March oo

single knots. 9.7.02 letter:

No signs of illness.

14. 6.99

60 85 621

Almost healed. irregular

bandage. 23./6. 02: On

right nostril edge one

small wound. (Tbc. pulm.)

14./6.99 118 78 27./9.00 UK stayed away. (Eco-

nomic reasons.) Much improved.

Gross, nose, both nasal cavities

cheeks, neck

6

small, right cheek

only

347 m. 9% small, nose, upper nasal bone

lip

341 m. 48 40

342 W.44 10

343 m. 24

344 W.48 17

346 W.37

348 m. 33 10

medium size, nose, upper lip,

both cheeks

*349 M. 25 10

8th

71 27 32

Very expanded, nasal cavity 17./6. 99 168 129

Almost healed. Since oo few, whole face, neck

distributed standing nodes (Tbc.

pulp.)

Very spread out, nasal cavity, 17th/6th c. 99 174 253 95 9th/4th 01 Healed *). 25./06.02 Letter: None

whole face, neck

lips,

symptoms.

gums,

throat

Small, nose, left nasal cavity, 19th/6th c. 99

Temporary improvement.

cheek

gums,

malicious. mucosal disease with

Palate,

repeated small

maw

break.

Small, nose, both nasal cavities 23./6. 99 53

6 6

Almost healed. Since Oct 99 only

cheeks

single knots on the nose.

Medium-sized, nose, nasal cavity 24./6. 99 102

38 33

Significantly improved. U.N-

upper lip, both

regular treatment; since

cheeks

October 99 only distributed standing

Node.

Medium-sized, nose, nasal cavity 27./6. 99

23./9. 99 Healed. Medical Report No. 74.

both cheeks, l.

Ear

small, nose

nasal cavity 27./6. 99 66

11./9. 99 Almost healed. Continued Light

treatment in St. Petersburg.

354 m. 30 20

73

355 m. 24

4

*) Plate XXVI.

7

83 61 42

Very expanded, nasal cavity 28./6. 99 112 118 12./9. 00 UK Died Nov, or an

nose upper lip,

Kidney disease and tuberculosis pulm. both cheeks, neck

Significantly improved. Very spread out, nasal cavity, 29./6. 99 127 55 – 18./11. 00 UK disease. (Eye trouble, whole face, throat palate, throat

later total blindness.) Almost

healed. 1./7.01: Good scar

tissue, single doubtful

Node.

Gross, nose, both nasal cavities 1.17. 99 77 47 28./4. 00 Almost Healed. Since oo only single

cheeks, 1st ear,

distributed nodes. Because

throat

disease not treated. (TB.

pulm.) medium-sized, nose, nasal cavity, 1./7. 99

Partially healed. malicious

upper lip,

both upper lip,

mucosal disease with re-

cheeks

gums,

caught small outbreaks (Pau-

palate

perism).

Very expanded, nasal cavity, 3.17. 99 127 114 201

Significantly improved. evil

whole face, neck, upper lip,

type case with deep infiltration. upper extremities gums,

02/06/09: Partly good scars palate

education, only distributed standing

nodes (Tbc. pulm.). Large, nose, upper nasal cavity, 3rd/7th 99 136 52 9/5.00 Healed. Medical Report No. 75. lip, both cheeks upper lip,

gums,

palate

big, r. cheek

4th/7th 99

80 80 110

Almost healed. Irregular

Treatment. 26./5. 02: Good scar tissue, single, distributed nodules.

3

*361 W.27 14

359 m. 14

360 m. 12

362 m. 51 7

*) See Plate XXVII.

19./8. 99 Almost healed. 1901: Recurrence

under pregnancy. 9th/9th 02: Only

few, distributed knots.
Almost healed. Since Sept 99 only

single small knots.
5th/9th 99 Healed. Medical Report No.77.

Almost healed. stubborn

Mucosal disease, repeated

small outbreaks (Tbc. pulm.). 11/11 99 Healed. Medical report no. 78

370 W.31 19 medium size, nose, nasal cavity

upper lip, both

cheeks 371 M. 39 20 small, nose nasal cavity, 15.17. 99

gums

6./9.00 Healed. Medical Report No.79.

372 m. 14 9

17/17/99 108 104

very spread out,
both cheeks, chin,
neck, 1st ear
big, nose, lips, nasal cavity,

lips, Gau

7

7/18/99 84 113

men, Keble

374 W.16 3 small, 1st cheek 375 M. 27 23 large, 1st cheek

7/19/99 25

19./7.99 52

nasal cavity,

gums

24

376 W. 25 %Small, Nose

nasal cavity

20./7.99

61

46

82

Almost healed. 5. 4. 02 letter:

Gule's scar tissue, just one.

individual nodes (spondylit. cervic.).

15./10.00 Healed *). 15./11. 00: None

symptoms of illness; late.

not seen.

14/9/99 Healed. Medical report no. 80

24

Almost healed. 3.2. 02: Good

Scar tissue, some doubts.

tacky knots. 69

Temporary improvement.

Persistent mucosal disease

with repeated small

break.

18.4.00U. K. died summer oo

(Spondylit. cervic., Tbc. pulm.).

Almost healed. 4th/6th 00: Good

scar tissue, few, distributed

standing knots.

8/31/00 | Almost healed. 14th/2nd 02 letter:

Good scar tissue, go ahead

the nose single knots,

which are treated in-house

will.

15 24/01/06 Healed*). 18.4. 02: None

symptoms.

Significantly improved. U.N-

Regular treatment (Tbc. pulm., albuminuria).

17/20/99 116 76

Very expanded, nasal cavity,

whole face, r. upper lip, ear, neck

gums

378 W.40 26

Medium-sized, nose, nasal cavity

both cheeks

380W'. 28 7 large, nose, upper nasal cavity,

lip, both cheeks lips, tooth

flesh

373 m. 22

377 W. 27 17

379 W. 36 6

17/26/99 32 66

21

387 M. 47 16 | Medium-sized, nose, nasal cavity 10./8. 99

both cheeks, r.

Ear 388 W.36 24| Medium-sized, nose, nasal cavity 14./8. 99

upper lip, b, wang.

14th/10th 99 Healed. Medical report no. 82

389 M. 103', small, r. cheek 390 m. 24

10 Gross, nose, upper nasal cavity, lip, both cheeks gums,

palate

16./8. 99 17./8. 99 104 73

7th/12th 99 Healed. Medical report no. 83. 5./6. 00 Healed *). Died July oo

(Typhus?), Medical report no.

132

Healed*). 10th/6th 02: Good

scar tissue, a small one

Node. 08/01/02: No sick

health symptoms.

Almost healed. Irregular

Treatment. 19./6. 00: Good

scar tissue, 4 small knots.

(Tbc. pulm.)

Partially healed. 27./5. 02:

Only a few knots on the nose,

otherwise good scar tissue. 21/10.99 Healed. Medical report no. 84

22

Very extensive, nasal cavity, 31/8.99 115 117 36 whole face, neck lips, tooth meat, Gau

men, throat 5small, 1st cheek

1.9. 99

Almost healed. stubborn

mucosal disease with again

caught small outbreaks.
Almost healed. 20./9. 02: over

all good scar tissue, just up
the prolabium of the upper lip

a few small wounds.
10.9. 99 UK Missed out, without

give reason.

391 W. 24

392 W. 48

393 m. 191

394 m. 61

395 W. 18

*396 W. 32

397 W. 17

8th

*) See Plate XXVIII. Large, nose, upper nasal cavity 33 81

9

9/2/99

lip, both cheeks
Large, nose, upper nasal cavity,
lip, both cheeks upper lip,

gums
Big,

ear, neck

87 140

401 W. 48 10

Cheek,

2.9. 99

78 119

74

402 W.! 9'/]

5. 9. 99

7

3

2

medium-sized, nose, nasal cavity,
upper lip, 1st cheek gum,

palate

Gross, nose, both nasal cavities

cheeks, r. poor

Partially healed. 7.15. 02:

Good scar tissue on which

Ears single knots.

Significantly improved. bad.

like mucosal disease with

repeated small. outbreaks.

Almost healed. 28/5 02: Good

scar tissue, only on the

right cheek 2 small lumps, UK Died 19.6. ooh on

acute confusion. Almost healed.

12.9. 99

97

89

23

398 W. 44 22

399 W. 36 20

400 W.'15

*403 W. 25

404 W. 30 15

405 W. 18

cheeks

cheeks

5 medium-sized, nose, nasal cavity 13.9. 99

Almost healed. Treatment of upper lip, both

Canceled 31/3.00—1/7.01. 2nd/5th 02: Good scar tissue,

single dubious knots. 406 w. 16% | small, nose

nasal cavity 13./9. 99 23

10/10.99 Healed. Medical Report No.85. 407 W. 38 7 small, nose

nasal cavity 15.9. 99 57

4th/12th 99 Healed. Medical report no. 86. 408 W.32 12 large, nose, upper nasal cavity, 16.9. 99 113 202 129

Significantly improved. 29.4.
lip, both cheeks, lips, teeth

02:Only distributed nodes
Chin, 1st hand
flesh

(Mb. cordis. Albuminuria, Tbc.

pulp.).

409 W. 27 7 medium-sized, nose, nasal cavity, 19th/9th 99 92

26

1st/2nd 00 Healed*). Sept. 00: No upper lip, both gums

Symptoms, later

heard nothing.

410 W.171

Large, nose, both nasal cavities, 21./9. 99 90 225 341

Almost healed. 20th/5th 02: Up

cheeks, neck

throat

a small wound on the nose

otherwise good scar tissue. 411 f.'16 34 small, nose, upper nasal cavity, 22.9. 99 54

1st/9th 00 healed. Medical report no. 87. lip

Palate,

throat

412 M. 18 4 medium size, nose,

26.9. 99 81 61

23./7. 00 healed. Medical report no. 88. both cheeks, left.

upper eyelid. 413 W. 53 6 Small, Nose

nasal cavity 27.9. 99 82 46 (2) 8.3. 00 Healed, medical report no. 89
414 W.10 5 Small, nose, upper nasal cavity

9/28/99
32

28./8. 00 healed. Medical Report No.90.
lip, both cheeks
415 W.66 30 medium, right

10/3/99

65

Healed *). 31./5. 02: None

symptoms.

2

II

37

81

cheek

416 m. 19 1st, small, nose

Nasal cavity, 3. 10.99 67

Healed*). 28.4. 02: 2 doubt-

maw

sticky nodules. 5th/10th letter :

No signs of illness.

417 M. 12 1', Small, Nose, 1st Cheek Nasal Cavity, 6th/10.99 34 44 14 3rd/10.01 Healed *). 7/20/02 Letter: None

gums,

symptoms.

palate

418 M. 27 17 Very expanded, nasal cavity 7. 10.99

5 4/9/01 Almost healed. 6th/10th OI: Im

whole face, neck,

face no disease left hand

appearances, the hand still

attacked.

419 w.21

9 medium-sized, nose, nasal cavity, 7./10.99

28

64 2 9/12/01 Healed *). 8th/4th 02: None

Upper lip, both lips, Zahni.

symptoms. (TB.

cheeks

palate, throat

pulp.)

420 W.47 11 Very wide, nasal cavity, 10/10.99 111 72 9.17.00 UK Negative result.

whole face, neck lips, tooth

(Hopeless case with El-

meat, palate

phantiasis.) Slight exposure.

(Tbc, lung.)

421 W.33 10 Gross, nose, both nasal cavities, 10/12/99 70 116 56 25./01/08 Healed*). 7/26/02 Letter: None

cheeks

symptoms. (TB.

pulp.)

422 W. 28 18 Very spread out, Nasehöble, 16./10.99 51 282 155

Significantly improved. Deep

whole face

lips,

infiltrated affection with palate, throat

little chance of recovery. (Tbc. pulm.) 423 W.45 30 Very expanded, nasal cavity 16./10.99 64 404 406

4 medium size, nose, nasal cavity, 17./10.99 29 72 27 upper lip

Palate 425 W.25 8 large, nose, lips, nasal cavity, 18/10.99 26 67 both cheeks

426 W.48 n Gross, nose, upper Nose, 19./10.99 63 1 62 lip, both cheeks

Significantly improved. ge

little prospect of healing, there
the general condition very much

bad is.
Almost healed. Since Sept 00:

Good scar tissue, only on
1. nostril edge a hard

persistent wound. (Tbc. pulm.)
14/7.00 Almost healed. 15./8. 02 letter:

Good scarring, single

fresh knots which the

patient ignored.

Partially healed. 29.15. 02:

A large one on the lower lip

Wound, otherwise only a few

Node.

3. 2.00 UK Died October oo at

canc intestinal. Essential ge

improves.

21.10.99 UK Missed out.

22./12.99 UK Illness. (case hoff-

unglos, Tbc. pulm.) Pat, almost

blind. Low impact.

Significantly improved. 7th/1st

02: Partly good scar

tissue (Tbc. pulmonary

stretched osseous tbc.)

13./10.00 Healed *). 14th/7th 02 letter:

No signs of illness. (Tbc. pulm.)

29

palate

430 W. 15 4 large, nose, right nasal cavity 24. 10.99 58 177 148

all. face, scalp, 1st ear, neck,

right hand

424 W. 16

upper lip,

gums,

lips, tooth

meat, palate

gums

427 w.48

7 large, left cheek,

ears, neck.

19.10.99 57

428 W.27 12 Large, Neck

20th, 10.99

429 W. 49 14 Very expanded, nasal cavity, 23./10.99 50

whole face

lips,

cheek, both upper extremities

431 W. 50

2 small, nose, 1st cheek, Nasehöble, 30th, 10.99

palate

36 34

432 W. 30 10

Medium-sized, right nasal cavity

1. II. 99

43

44

only

cheek

1.11. 99

53

19

433 W. 23 16 medium-sized, vase, nasal cavity

both cheeks, throat 434 W. 20 4 medium size, nose, nasal cavity

Upper lip, 1st cheek

11/6/99 36

74

vase cave

11/6/99

29

6 12/23/01 Healed*). Since March 00

single knots. 4/14/02:

No signs of illness. 14, 2.00

Healed*). 14.4. 02: A A

single knot.
Healed*). recurrence. 4/13/02:

Partly good scar tissue,

on the nose a part knot.

9/9/02: No illness

appearances. (Tbc. pulm.)

12/20/99 Healed. Medical Report No.91.

(Tbc. pulm.).

1. 10. 00 Healed. Medical Report No.92.

28. 5.00 Healed. Medical Report No.93.

27./3. 00

Healed*). From 27.3. oo in approx.

2 years no illness

appearances. 16./8. 02: In

recent strong

lean; on the nose 2 fresh ones

nodules; healed 1/4.02 AD

10 séances light treatment.

23 | 7. 3. 00 | cured. Medical Report No.94.

nasal cavity

435 m. 60 35 medium size, nose,

upper lip, b. Wang.

436 m. 23

4 Small, nose

437 sts. 18 5 medium, 1st ear.

* 438 W.18 3 medium, nose,

Upper lip, 1st cheek

nasal cavity

43

9th, 11th 99th

5 23

439 f. 16' 2'12 small, forehead

*) See Table XXX.

22 104

both cheeks

441 W. 27 12 Small, Vase, upper nasal cavity

11/14/99 26

lip

*442 W.38 10'/, Very expanded, nasal cavity, 16. 11. 99 32 247

Cheeks, chin, palate

* 443 m. 21 9 large, nose, upper nasal cavity 21.11. 99 35 169

22., 11. 991 34 229 nose, upper lip, r. cheek, temple, r.

27 446 W. 10 8 small, r. cheek, l.

11/25/99 7 24 Yates

30

Almost healed. Irregular

Treatment 1015./11. 01 Healed*). 2nd/5th: None sick.

health symptoms. 95

Almost healed. 1.17. 02: Good

Scar tissue, three in all

up to four small knots.
21.,7. 00 healed. Medical Report No.95.

99 34 2

22 43 21 196 174

02:

27th, 11th 99 29 48

93

29

Temporary improvement.

Repeated eruption from the nasal cavity. 4/2/02: A few small knots.

440 W. 23 4 medium-sized vase, nasal cavity 13. 11. 99

Nose, lips, both lips, tooth

lip, both cheeks

right Temple 444 W.60 30 Very spread out,

ear, hair bottom, neck * 445 W. 17 2 small, r. cheek

11/22/99 6

47 W. 40 20 | small, nose

Nasal Cavity 25th, 11th 99 448 W. 37 26 Very expanded, Nasal Cavity, 26th, 11th 99

whole face, r. lips foot

** 49 W.22 6 medium, nose,

forehead, r. Wanger. poor
450 W. 521, Small, Nose

Nasal cavity 28.'11. 99 27

*) See Tables XXX, XXXI, XXXII, XXXIII and XXXIV.

451 W.21

2

from

2

Small, nose, upper nasal cavity 28.11. 99 28 121 59

Healed*). Repeated Auslip!. cheek

rupture of the mucous membrane, 27./6. 02: No disease

appearances. 452 W.31 3 medium-sized, nose, nasal cavity, 28. 11. 99 29 73 811.10.01 healed *). 22./6. 02: No 1st cheek gums

symptoms. 453 sts. 10 small, 1st cheek

28. II. 99 9

15/12.99 Healed. Medical Report No.99. 454 m. 18 12 medium, neck

1.12. 99

IO 28 16./2.00 Healed. medical report No. 100. 455 W. 34 22 Gross, Vase, Lips, Nasal Cavity, 6./12, 99 10 269 185

Significantly improved. 18th/6th both cheeks, neck lips, tooth f.

02: Partly good scarring

formation, quite numerous knots. 456 W. 54 20 Very expanded, nasal cavity 6. 12. 99

21 225

54

Significantly improved. hope

nose, upper lip,

unrelated case with

both cheeks, forehead,

hanging deep infiltration. hair floor, neck, r.

Low prospect of complete

and !. upper extremity.,

this healing

1. Sub-Extreme.

457 M. 2018 Small, r. cheek

7th 12th 99 8th

15./12.99 UK Missed out. Not

seen later. 458 m. 38 12 small, nose

nasal cavity 7. 12. 99 32 27 | 12/27/01 UK Negative result.

temporary improvement,

repeated outbreak. 459 W.28

nasal cavity 8./12. 99

56

8. 8. 00 Healed. medical report No. 101

20

W. 28 7 Small, nose

approx

2

4/27/00

461 W. 29 small, nose

Nasal cavity 11./12.99 50

462 M. 33 15 Very spread out, nasal cavity, 12th/12th 99 16 210 103

Nose, 1st ear, throat, lips, tongue,

Breast

palate

463 W. 24 15 Very expanded, nasal cavity, 3rd/1st 00 268

Nose, upper lip, 1st upper left, gums,

cheek, r. ear, throat palate

464 M. 28 10 medium size, I, hand palate,

4th/1st 00

throat

108 52

UK disease. evident

improved.

cured. medical report No. 102

Almost healed. 9.7 02: Everywhere

good scar tissue, just up

a few small knots on the ear.

Almost healed. 8/1/02: nice

scar tissue, only 2 small ones

Node.

Significantly improved. U.N-

regular treatment. 13th/3rd

02: Partial scarring,

nor knots along the affect.-

edge. (Tbc. pulm.)

Healed*). 07/08/02 Letter: None

symptoms.

Almost healed. stubborn

Mucosal disease with small
outbreaks. 30.5. 02: None
clear signs of illness.

ments.
Healed*). 18./12. 00: None

Symptoms later

not seen.
Healed *). 3./7.02: Good Nar-

tissue, no disease
appearances.

9th/1st 00

68 39 9.17.01

465 W. 17 4 small, nose, upper nasal cavity

lip

466 W.62 24 medium, nose, nasal cavity,

both cheeks

upper lip

9th/1st 00

153 32

467 W.45

-

209 59

right Foot

468 W. 19 5 large, nose, upper nasal cavity, 18.1. 00

lip, I. cheek, r. upper lip, shoulder and hand, gums,

Palate 469 W. 34 18 small, nose, upper nasal cavity 22nd/1st 00

lip

89

9 12.7. 01

cured. 5/8/02 Letter: None

symptoms.

*

23.1. 00

209

38

*471 W. 15 14 Gross, I. Hand and

Arm 472 m. 28 13 small, nose, upper nasal cavity

lip, r. cheek

24.1. 00

45

14

9./5.01 Healed*). 22. 9.02 Letter: None

clear signs of illness.

ments.

18.,6.01 Healed *). 4/20/02 Letter: None

symptoms.

12.6.01 UK Missed. (eco

mixed reasons.) Stubborn

mucosal disease with re-

caught small outbreaks.

Almost healed. treatment from

5.17.00—7./6. 02 aborted,

7/22/01 Healed*). 8.7 02: Beautiful

Scar tissue, no signs of disease.

473 M. 24 18 large, nose, upper nasal cavity, 24./1. 00

lip, both cheeks, upper lip,

Forehead

gums

*474 W. 55 13 Very spread out,

29.1. 00

nose, upper lip,

both cheeks, forehead,

throat

475 W. 24 8 small, nose upper lip nasal cavity 1./2.00

476 W.46 15 Very expanded, nasal cavity 1./2.00

nose, upper lip,

both cheeks, forehead,

right forearm

*) Plates XXXV and XXXVI.

1st/2nd 00

42

477 W.34 15 medium size, nose, nasal cavity

upper lip,

both cheeks

2.2. 00

88

478 W.22 4 medium-sized, nose, nasal cavity

both cheeks 479 m. 35 30 Very spread out,

1. cheek, ears,

throat

480 W. 50 4 medium, forehead

13 | 11./5.01 Healed*). 6th/5th 02 Letter: Im

right nostrils a sore up

to the edge of the nostril,
internally no disease

appearances.
51

Healed*). 9/9/02: No sick.

health symptoms. (Tbc. pulm.) 66

Almost healed. 15./1. 02: Good

scar tissue, only on the

Jibe distributes standing knots. 71

UK Negative result.

Temporary improvement, be

constant new outbreaks. 14 26./11.01 Healed*). or only single knots

Ten. 25./8. 02: No sick.

health symptoms. (Tbc. pulm.)
88 23./11. 01| Significantly improved. (Pau-

perism.) 22./11. OI: Good

scar tissue, single

node, spring 02 again

multiple knots.

Almost healed. 6/10/02: Everywhere

good scar tissue, just up

single knots on the nose.

6. 2. 00

193

481 m. 20 18 Very spread out,

both upper, r.Unter

extremity

482 M. 13 V2 large, nose, upper nasal cavity,

lip, both cheeks, palate, throat

1. Thigh

8. 2. 00

136

only

10. 2, 00

268

124

OI:

483 M. 30 4/2 Very expanded, nasal cavity,

nose, upper lip, r. upper lip,
cheek, throat palate,

throat
484 W.23 17 Medium, both

cheeks, 1st temple,

both arms * 485 M. 61, small, 1st cheek

*) See Plate XXXVII.

493

10th/3rd 00

7

67 52 Gross, nose, both

Cheeks » 37 25 Medium size, nose, nasal cavity

both cheeks, neck

494

10th/3rd 00

136

4th/12th 00 Healed*). 1st/6th 02 Letter: None clear signs of illness

ments.

17th/3rd 00 | UK Died 26/3 00 (in

fluenza, tuberculosis pulm.).

7th/9th 00 Almost healed. 10th/11th 01: Since

the treatment only a few

small wounds which they

self treated.

20./7.00 Healed. medical report No. 105

Healed*). 1st/7th 02:

No

symptoms.

63

154

496

495 26 6 Small, nose

Nasal cavity 10.3. 00

26 14 medium-sized, nose, nasal cavity, 12th/3rd cent. 00

upper lip, both gums,

cheeks

palate

497 34 12 large, nose, upper nasal cavity 15./3. 00

lip, both cheeks

498 M. 19 2 medium-sized, nose, nasal cavity 19th/3rd 00

upper lip, both

cheeks, neck

20th/3rd 00

191

15

.

499 W. 32 16 large, nose, upper nasal cavity

lip, both cheeks
500 m. 29 29 Very spread out,

right cheek, 1st upper
and lower extremity

23./3. 00

225

118

.

Low impact. bad

nice case, despite
action somewhat extended.

(Tbc. pulm.)

29./5. 01 Healed*). 2.17. 02 Letter: None

symptoms.

Almost healed. 21./7. 02 letter:

face free, on the extremities

would do single nodes. (TB.

pulm.) 27.17.00 UK Missed. essence

slightly improved. 12./9. 01 Brief: Good scar tissue, only scattered knots.

24./3. 00

108

501 W.41 17 Very spread out,

nose, both cheeks,

forehead, hair floor,

throat

168

27./10. 00 UK Died 7th/11th 00

(Tbc. miliar.?) Visibly improved.

48

17th/12th 00 Healed*). 3./4.02: Good Nar

benwebs, two dubious ones

nodules.

22./9. 00 UK Died. Significant

improved.

2

276

504

Large, nose, lips, nasal cavity, 30./3. 00

right cheek, upper lip,

eyelid

palate, throat

505 W.18 4 small, upper lip upper lip, 30.3. 00

gums,

palate

506 M. 19 2 small, nose, upper lips, tooth 31./3. 00

lip

meat, palate

throat

26. 3. 00

502 W. 51 8 Very expanded, nasal cavity,

Nose, lips, both upper lips

cheeks, ears,

chin, neck

503 M.! 8 6 Small, r. poor

27./3. 00

6th/4th 00

507 W.44 30 Very spread out,

nose, upper lip,
both cheeks, forehead,
Neck, 1st upper extremity.,

body 508

, 21 2 Small, nose

nasal cavity

6./4.00

60

8th/9th 00

cured. medical report No. 106

10

509 W.10 Small, I. Cheek 510 M. 20 3 Large, Nose, both nasal cavities

cheeks, neck

511 W. 18' 21, small, nose, 1st cheek nasal cavity

512

" 40 10 small, nose

nasal cavity

513 48 40 Small, 1st ear

9.4. 00

9th/4th 00

10.4. 00

65

76

42

32

8.'5. 00 healed. medical report No. 107. 2.9. 01 Healed*). 7/20/02 Letter: None

symptoms.

20.7. 00 healed. medical report No. 108

19/9 00 healed. medical report No. 109

Significantly improved. U.N

regular treatment. 1.7.

02: Partly good scar

tissue, nor knots.

27./4. 01 Healed*). O1: nice scar,

only single nodes. 6.4. 02

Letter: No signs of illness

ments.

25./4. 01 Healed*). O1: nice scar,

just a small wound. 6.4.

02 Letter: No sick people.

appearances.

1.8. 00 UK disease. partially

heals. 24. 12.01 letter: cheeks

free, by the way still knots. Almost healed. Irregular

Treatment. 1.4. 02: Good scar tissue, standing nodes and small ones distributed in the margin

wounds.

21./10. 01 Healed*). (Malicious Slime-

Bauleiden, tuberculosis pulm.) 26.4.

02: No signs of illness.

ments.

518 W.23"/12 Small, Nose

nasal cavity, 23./4. 00

throat

519 W.25 12 medium, upper

lip, 1st cheek

520 W. 30 1 Medium, left

cheek

* 521 W.22 7 large, nose, upper nasal cavity

lip, both cheeks 522 m. 30 13 medium size, nose, nasal cavity

right Ear

*523 W.22

2 small, nose

nasal cavity

30.4. 00

97

14:17. 00 Almost healed. 7/25/02: Again

some fresh knots. 39 26./10. 01 Healed*). Since Jan. 1901: Only

single dubious knots.

67

2.11. 01 Healed*). 30.5. 02 : None

Illness symptoms (Tbc.pulm.)

24./10. 00 Healed*). 7/27/02 Letter: None

symptoms. (TB.

pulp.)

30/.11. 00 Healed*). 8/30 02:

symptoms.

18/9 00 healed. medical report No. 110

33

Healed*). Irregular Be.

plot. 28.15. 02: Good scar tissue all over, few knots.

12. 10. Letter: None

symptoms. 315

Significantly improved. 16.8.

02: Good scarring all over, standing knots distributed.

No

41

524\. 24 24, small, nose
525 m. 40 4 medium-sized, nose, nasal cavity

upper lip, both

1./5.00
4.5. 00

83

cheeks

166

only

526 M. 18 8 Very expanded, palate, throat 4./5.00

1st cheek, 1st ear,
1st temple, hair bottom,
neck, 1st shoulder and
hand, both sub.

extremities, body
*)p. Plates XXXVIII and XXXIX.

II2

* 527 M. 17 4 medium-sized, nose, nasal cavity, 10./5.00

Upper lip, both gums, throat

cheeks
528 M. 23 2 medium-sized, nose nasal cavity, 11./5.00

16

3./12, 00 | Healed*). 1./7.02 Letter: None

symptoms. (TB.

pulp.)

Almost healed. treatment from

28/5 00—25./2 02 canceled

chen. 9th/6th 02: Good Scar

tissue, few knots. (TB.

pulp.)

6th/9th 01 Healed*). Stubborn mucus

skin condition. Since Nov 1900:

skin free. 9./6.02 Letter: None

symptoms.

24./9. 01 Healed*). 01: Just a two-

faulty knot. 2./6 02:

No signs of illness. 27.17. 00 Almost healed. O1: light treat ment in St. Petersburg. 5th/1st 02 Letter: No illness

appearances. 9.9. 01 Healed*). or: Nice scars

tissue, just jibe

few knots. 18.9. 02 letter:

No signs of illness.

Almost healed. Good everywhere

scar tissue. Since Oct. 1900

only distributed nodes. Significantly improved. 18th/6th

02: Good scar tissue everywhere, only once, distributed standing. Node.

at the

palate, throat

529 M. 15 6 medium size, nose, nasal cavity, upper lip, 1st cheek upper lip,

gums,

Palate, Throat 530 W. 32 7 Small, Nose

nasal cavity

531 M. 32 30 Gross, 1st Upper and

lower extremities

532 W. 24 16 medium size, nose, nasal cavity

upper lip, both
cheeks, neck

533 W.30 12 large, nose, upper

lip, both cheeks,

Chin 534 m. 21 17 Very expanded, nasal cavity

1st arm

*) See Table XL.

2. 6. 00

171

37

535". 52 25 Very spread out, nasal cavity,

whole face, both lips upper extremities

Almost healed. 25./6.02: Everywhere

good scar tissue, only on the lips and 1st hand

some small wounds. heal. medical report No. III.

2

536 W.27 20 Medium size, both nasal cavities

cheeks, r. poor
537 V. 16. 11. Small, nose

nasal cavity
538 m. 18 small, nose

nasal cavity,

throat

539 W.'15 10 Medium, right

cheek, neck

7.6. 00 7th, 6th 00

30. 6. 00 30.8. 00

cured. medical report No. 112

cured. medical report No. 113

I

64

540W 8

4 Medium, left

Cheek, 1st hand 541 W. 14 4 Small, I. Cheek

12.6. 00

15

4 31st, 8th 01 Healed*). 01: Beautiful scars

tissue, just a dubious knot.

25./7. 02: None

symptoms. 62 2nd, 12th 01 Healed*). 15.17.02 letter: None

symptoms.
29/10 00 Healed*). 9.6. 02: None

symptoms.
4 16. 2. On Healed*). 01: Beautiful scar-

tissue, a small knot.
21./5. 02 Letter: No sick.

health symptoms. 9/13/00 Significantly improved. sat

continued the light treatment in London.

13 /6.00

I 28

90

9 Large, nose, upper nasal cavity

lip, both cheeks, r. Ear

8 large, nose, upper nasal cavity, 18th/6th 00 lip, both cheeks palate,

throat

38

24

547 W. 21 */12 large, nose, upper nasal cavity 19.6. 00

lip, both cheeks,
throat

Almost healed. O1: Nice Nar

venous tissue, distributed standing knots. 8th/7th 02 Letter: Only

some knots on the ear.

Almost healed. Since Dec 1900

only a few distributed standing

Node.

5/18/01 Healed*). 01: nice scar,

few, distributed knots

18.5. 02: No sick

health symptoms.

Almost healed. Irregular

Treatment. February 23/6: Everywhere

good scar tissue, in the margin

of the 1st nostril a small one

Wound. 4/10/01

Healed*). 3rd/5th 02 Letter: None

clear signs of illness

ments.

Almost healed. Since Dec 1900:

Good scar tissue; only one-
individual knots around a Thrae-

neural fistula.
Significantly improved. U.N-

regular treatment. 10th/4th
02. Partial good scar-
weave a part distributed standing
Node.

5 Small, nose

nasal cavity

20. 6. 00

22

26

544 W. 45

545 m. 21 19 big,

Forehead,

throat

546 W. 30

548 W. 48

549 l. 50

20. 6. 00

2 medium-sized, nose, nasal cavity

left cheek and ear

63

17

nasal cavity

550 W. 44 4/2 Large, Nose, Upper

lip, both cheeks

25. '6. 00

64

43

142

22

2

551 W. 55.4", Very expanded, nasal cavity, 25./6. 00

Nose, upper lip, upper lip both cheeks

13.5. 01 Almost healed. or: Nice Nar

tissue, only a few knots on the nose. 3rd/10th 02: Some distributed nodes

after facial rose.
23./7. 01 Almost healed. 22./8. 02: Good

Scar, just a small knot.

6/27/00 Healed. medical report No. 114

8th/9th 00 healed. medical report No. 115

Healed*). 28./5.02: face free,

around the neck a few dubious ones

Stains. 21./8. Letter: None

symptoms.

1st/10th 00 secret. medical report No. 116

Temporary improvement.

Repeated outbreak of the

slime build (Tbc. pulm.)

8th/9th 00 healed. medical report No. 117

Almost healed. stubborn

mucosal disease. Since 1901 only single knots.

137

II

560 W.24 10 large, nose, upper nasal cavity, 11.17. 00

lip, both cheeks, gums, neck, I. arm

Palate 561 F. 7/12 Small, 1st Cheek

12./7. 00

6

N

Healed*). Since Dec 1900: skin

free, only mucous membranes and

prolabium attacked.
2.4. 01 Healed*). 3rd/4th 02: hardly any scar

visible, no disease

appearances.

18.9. 00 healed. medical report No. 118

29/9 00 Healed*). Died 30./3. 01

of tuberculosis pulm. medical report

Messages from Finsen's medical light institute. v, vi

No. 134

16./7.00

58

31

562 W. .23 I Small, Nose

Nasal Cavity 563 W.20 11. Small, nose, both

cheeks, r. show

finger

564 F. 28 5 Very expanded, nasal cavity

nose, both cheeks,

forehead, both

poor, r. hand

565 W. 34 12 Very expanded, nasal cavity

nose, upper lip,

both cheeks, neck 566 m. 66 58 gross, r. poor

Almost healed. Since Nov 1900:

Good scar tissue, only

divides standing nodes.

567 M. 38 19 Large, nose, upper nasal cavity

lip, both cheeks

Almost healed. Since Dec 1900:

Good scar tissue, only ver

divides standing nodes. 21.11. 00 UK disease. Significant

improved, affection complicated

with epithelioma. (Surgery.)

5th/11th 00 Healed*). 3./1.02: Good Nar-

tissue, on the right nasal

pierced a small wound.

21.7: No disease

appearances. 11.10. 00 Healed*). 20.4. 02

Letter : No signs of illness.

:

21. 7. CO

568 W.27 3'/, medium-sized, nose,

both cheeks

55

67

Almost healed. Since Dec 1900

only a few, spread out

Node. (Tbc. pulm.)

24./6. OI Healed*). 30.7. 02: None

symptoms.

Significantly improved. U.N-

regular treatment.

11.12. 00 Healed*). 5/29/02 letter:

No signs of illness.

Healed*). 9.7. 02: None

symptoms (tbc.

pulp.). 28.9. 00 healed. Medical Report No.119.

(Tbc. pulm.)

571 W.42 20 large, nose, upper nasal cavity, 28.7. 00

lip, both cheeks upper lip

572 W. 46, 18 medium size, nose, nasal cavity

30. 7. 00

upper lip, chin

573 W.441 9 medium-sized, nose, nasal cavity 6.8. 00

upper lip, both

Cheeks 574 M. 25 10 Small, Nose

nasal cavity, 7th/8th 00

Palate,

throat

575 W.27 11 Medium, left

9.8. 00

cheek and ear

576 W.54 8 Small, Nose

nasal cavity

9th/8th 00

19

Almost healed. 9/21/02: Cheek

free, single knots on the ear. Almost healed. stubborn

mucosal disease with again

bolten small outbreaks.

10th/11th 00 Healed *). 14./5.02 Letter: None

symptoms.

gums

11./8. 00

42

577 M. 23 8 large, both cheeks,

Neck, 1st foot. *) Plate XLI. 581 M. 22 17 Very expanded, nasal cavity 31.8. 00

13./8. 00

38

4

24.9. 01

579 W. 62 44 medium size, nose, nasal cavity

upper lip, r. cheek
580 W. 45 18 Gross, I. Hand and

poor

Healed*). Since May 01

single small knots. 25./7.
02: No signs of illness.

ments.
Healed*). 18.9. 02: None

symptoms.
Healed*). 8th/7th 02: Beautiful

Scar tissue, none distinct

symptoms.
Healed*). 28.3. 02 letter:

No signs of illness.

6.7. 00

103

57

106

91

11.4. 01

nose, upper lip,
both cheeks, neck,
both top eyes-

lids

582 W.11 small, nose, right nasal cavity 1.9. 00

I 2

29/9 00 Healed*). Medical report no.

cheek

I 20

583 M. 361, small, nose

nasal cavity

3. 9. 00

33

2

584 W.25' 23 Medium, right hand

hand and forearm

5. 9. 00

77

14

17th/8th 01 Healed*).

23./10.

Letter:

No signs of illness.

Healed*). Since Dec. oo only one

single doubtful spot.

7th/4th 02: No disease

appearances.

6.10. 00 Healed*). 19/9 02: None

symptoms.

8/23/01 Healed *). 13./9.02 Letter: None

clear signs of illness.

ments. 9/24/00 Healed. Medical Report No.121.

1 12

585 W. 29

586 W. 26

587 |W. 51

15, 9.00

N

Healed*). Stubborn slime

skin ailments with repeated
small outbreaks. 4/24/02:

No signs of illness.
Almost healed. Since Feb 01

good scar tissue, few,

distributed nodes.

4th/9th 01 Healed*). 9th/3rd 02:

No

symptoms. (TB.

pulp.)

Almost healed. Since Feb 01

only single nodes. Hard.

persistent mucosal disease.

3rd/8th 01 Healed*). 02/08/04: hardly any scar

visible, no disease

appearances.

3rd/4th 01 Healed*). 5./5.02 Letter: None

symptoms.

Almost healed. Since March 01:

Good scar tissue, few

distributed nodes. (TB.

(pulm.)

Healed *). 3rd/7th 02: None

symptoms.

27

592M. 6

2 small, 1st cheek

22./9. 00

4

5

:

593 w.21

594 W.22

6 small, nose, upper nasal cavity 22./9. 00

lip, 1st eyelid

2 large, nose, upper nasal cavity, 24./9. 00

lip, both cheeks upper lip,

gums

84

83

595 W. 27

1 small, nose, upper nasal cavity 25./9. 00

lip

19

17

2

64

27.9. 00 1 medium-sized, nose, nasal cavity, 28./9. 00

upper lip, r. cheek, gum,
throat

palate
5 medium-sized, nose, nasal cavity, 29./9. 00

57

nasal cavity

27/9 00 healed. Medical Report No.122. 183

Almost healed. malicious. mucus

skin ailments, repeated small

eruptions on the nose.
75

Healed*). Since Jan. or: Good

scar tissue, few,
divides standing nodes. 5.7.02:

No clear disease

appearances.

45 26./6. on Healed. *) 9th/6th 02: Good

scar tissue, no disease

health symptoms.

19./12. 00 Almost healed. 10/2/02: Beautiful

Scar tissue, single again

Node.

60

Significantly improved. U.N-
regular treatment. 16.9.

Only on the upper lip
clear knots.
Almost healed. treatment from

11/10.00—13/1.02 cancelled.

26.9. 02: Good scar

weave, single small knots.

167 13th/12th 01 Healed*). 29./7.02 Letter: None

clear signs of illness. (Tbc. pulm.)

3rd/10th 00

52

3 Large, nose, upper nasal cavity

02:

6th/10th 00

U.N

602 W. 7 5 medium size, nose, nasal cavity

72

603 M. 45 24 Very extended, nasal cavity, 6th/10 00 whole face, neck lips,

596 W. 7 597 M. 17.

small, right poor

upper lip, both gums

cheeks, neck

598 W. 27

*599 W. 34 10 medium-sized, nose

600 W. 26 19 Small, 1st cheek

601 m. 12

lip, both cheeks,

throat

upper lip, both

cheeks

gums

*) See Plate XLII.

12.12. 01 Healed *). 30. 4.02 Letter: None

symptoms.

11/17 00 Healed*). 15.8. 02: None

Signs of illness, scar

little visible. 4.1. 01 Healed*). 1 2/2/02: Smaller

Eruption from the mucous membrane

outside of the originally

traded

Almost healed. 26./6. 02: Good

scar tissue, few, distributed

standing knots,

24./10. 00 UK Remained without

give reason.

23./10.00 Healed *). 21.8. 02: None

symptoms.

4/15/01 Almost healed. 21./12.01 letter:

No clear disease

appearances. Spring 02:

A few knots will be im

treated at home. 8. 12.00 Healed *). 8.8. 02: None

symptoms.

169

610 W. 37

14 medium-sized, nose, nasal cavity 18./10.00

upper lip, r. cheek

65

77

61 W. 38

4 Small, nose, right nasal cavity 20.'10. 00

35

Cheek 612 W. 32 16 Large, 1st Cheek, Neck

23. 10. 00

42

73

613 W.65 3:12 medium size, nose, nasal cavity 24. 10. 00

*616 F.'18 6', medium sized, nose,

30. 10. 00

19

4

3. 'I 01

Healed *). 5/12/02: Good

Scar tissue, none distinct

symptoms.

Healed*). Spring 02: Right

major recurrence. 8/6: None

symptoms.

Healed*). April 16, 2002 letter:

No signs of illness.

Healed*). 2. 8.02: No German

common symptoms.

Healed *). 17.10. 02: Beautiful

scar tissue, no disease

health symptoms.

Heal*). 5. '9.01: No German

common symptoms.

Almost healed.

7/9/02: Am

ears a knot, otherwise none

symptoms.

Healed*). 5.5. 02: Beautiful

Scar tissue, none distinct

symptoms.

20 Large, nose, upper nasal cavity

lip, both cheeks

2 small, 1st ear,

upper eyelid, 1.

poor

10 Very expanded, nasal cavity

nose, upper lip, r.

cheek, 1st obr, neck,

both arms, body

mlarge, nose, upper nasal cavity

lip, both cheeks

and ears

Healed*).

clear tongues.

6.9. 02: No diseases hei

both cheeks

614 W. 29 14 Small, Nose

615 W. 25

1 small, nose

1. Cheek

617 W.27

618 W. 15

*619 W. '24'

620W 47

*) See Plates XLIII and XLIV.

14th/12th 01 Healed *). 26./7.02 Letter: None

clear signs of illness.

ments. 23/9, 01 Healed*). 01./04.02: hardly any scar

visible, no disease

appearances.
16th/2nd 01 Healed*). 2nd/3rd 01: None

Symptoms later

not seen.
Almost healed. Since April or

only small knots.

30./8. 01 Healed *). 27/12 OI letter:

No obvious illness

appearances.

Significantly improved. U.N-

regular treatment.

Almost healed. Since March or:

Good. scar tissue, few,

distributed nodes. (TB.

pulp.)

Significantly improved. Hard-

Persistent mucosal disease with repeated small eruptions.

629 W.47 15 large, nose, upper nasal cavity 20th/11th 00

34

115

26./11. 00

32

83

3rd/8th Oi

Almost healed. Since March 01

only a few, spread out

Node.
Healed*). Since March or: Ge-

clear view, on the hand
individual knots. 30th/5th 02 letter:

No signs of illness.
Healed*). 25./9. 02: None

symptoms.

23

8th

10th/1st 01

16

631 W. 17 1'/] Small nose, nasal cavity, 1./12, 00

palate

632 W. 23 15 large, both cheeks, throat 4./12. 00

throat

633 W.27 1'/, medium-sized, nose, nasal cavity 10./12, oo

11./12. 00

13./12.00

15

127 29.17, 01 Healed*). 4/3/02: No German

common symptoms.

80 23./5. 01 Healed*). 5./5.02 Letter: None

symptoms.

18./12. 00 Healed*). 3rd/11th 02: None

symptoms.

43 18./12. 01 Healed*). 15th/4th 02: None

symptoms.

52 9th/3rd 01

Healed*). 11./7. 02: Good

Scar tissue, none distinct

symptoms.

26./3. OI Healed*). 2.7. 02: None

symptoms.

24

nasal cavity, 14.12. 00

gums,

palate

17th/12th 00

II

185

1.7. 02: No signs of illness.

lip, both cheeks

630 W. 42 32 Large, r. cheek r.

hand

gums,

upper lip, r. cheek

634 W.13 7 small, r. poor

635 W.18

4 Medium, right

Cheek, Neck 21 Medium, right

cheek, neck

636 w.33

637 M. 12 192 Small, Nose

638 W.'16 15 Very spread out,

both cheeks, chin,

Neck, Body 639 sts. 18 13 Medium, left

cheek, neck

12./8. 01 Healed*).

clear

ments.
13th/3rd 01 Healed*).

clear
ments.

18./12.00

10

15

24. I. 02: No signs of illness.

nasal cavity

18./12.00

2

36 21./10. 01 Healed*). 7.7. 02 Letter: None

symptoms.
183 21./10. 01 Healed*). 22.7. Letter:

No signs of illness.

nasal cavity

2nd/1st Oi

02

640 W.33 3 medium, nose,

upper lip, b. cheeks

641 W. 40 20 Very spread out,

nose, upper lip,

both cheeks, forehead,

1st arm

642 W. 19 18 Very spread out,

both cheeks, 1.

Obr, neck, body

643 W.44 23 Very spread out,

nose, upper lip,

both cheeks, forehead,

1st arm

644 W.31 10 small, nose, upper

lip

645 W.40 40 Very spread out,

whole face, l.

ear, neck

nasal cavity

3. 1. 01

Almost healed. Since July or only

few, distributed knots.

9/8/02: Just a few doubt-

sticky spots.

Almost healed. Since July or only

few, distributed knots.

10/1/02: One on the forehead

small wound. face otherwise free.

9th/3rd 01 Healed *). 6.7. 02: None

symptoms.

Significantly improved.

Equal progress be.

meets decrease in infiltration

and knots.

25./6. 01 Healed *). 17.17. 02: None

clearly symptoms.

57

4th/1st 01

144

646 m. 28

4 Small, nose

nasal cavity

4.1. 01

71

227

only

69 | 10th/5th 01

Healed *). Since junior

few, distributed knots. 14.9. 02:

solid scar
tissue, no disease.

appearances.
Healed*). 11./3. 02: None

symptoms.
Healed*). Since May 01

few, distributed knots.

18./8. 02 Letter: No sick

health symptoms.

Healed*). 20.7. 02:

symptoms.

72

only

73 29.6. 01

No

4.1. 01

647 M. 35 30 Very expanded, nasal cavity,

Nose, upper lip, upper lip de cheeks, ears, neck

648 m. 17

5th/1st 01

6 medium-sized, nose, nasal cavity,

Upper lip, 1st cheek Throat 10 large, nose, upper nasal cavity

lip, both cheeks

649 W.62

5.1. 01

650 m./21

nasal cavity

10 medium-sized, nose,

upper lip, both

5th/1st 01

cheeks

651 W. 38

nasal cavity

6.1. 01

I 22

10 medium-sized, nose,

upper lip

652 |W.47

20 large, r. cheek

7th/1st 01

653 W. 44 30 Gross, nose, lips, nasal cavity, 9th/1st Oi
both cheeks

upper lip,
gums,

palate
654 M. 15 10 medium-sized, nose, upper lip 10./1. 01

upper lip,

both

cheeks, chin 655 w. 22 3 small, r. cheek

16.1. 01

Healed*). 11.8. 02 letter :

No obvious illness

appearances.

61

17th/5th OI Almost cured. 17.7. 02: Only

single knots.

146 21./11. 01 Healed*) Since July or only one-

individual, distributed nodes.

4.4. 02 Letter: No sick

health symptoms.

54 3rd/6th 01 Healed*) 17. 8.02 Letter: None

clear signs of illness

ments, 8 26.2. 01 Healed*). 22.7. 02: None

symptoms.

| 26./2

Significantly improved. cont

set light treatment in the

home,

Almost healed. Since May oi only

few, distributed stand. Node.

May 1st, 2002: Face free. On the

body 2 knots.

Almost healed. 28./11. 01 letter:

No signs of illness.

18.7. 02: Some again

fresh knots.

Healed*). Since junior

few, distributed stand. Node.

9th/6th 02: No disease

appearances.

Almost healed. Since July on

only distributed nodes.

1st/8th 02: Face to all

seem free.

Almost healed. Repeated small

Eruptions from the nasal cavity.

cheeks

nasal cavity

21./1. 01

125

only

nasal cavity

23.1. 01

224

*659 W. 40 2 medium, nose,

upper lip, both

cheeks, r. Under-

extreme.

660 M.18 7 Very spread out,

nose, upper lip,

both cheeks, neck,

Body

661 m. 16 24/2 small, nose, right

cheek and upper

Eyelid *) S. Plate XLV.

nasal cavity

23./1. 01

48

25.1. 01

107

whole face, 1. lips, gums ear, neck

25./1. 01

222

4.7. 01 Almost healed.

later light-
treatment in Munich.
Significantly improved. case

rather hopeless with big ones
destructions; almost total

blindness.
15./2. 01 | UK Died 25/2 01 on

Tbc.pulm.

26./1. 01

16

2

small, nose

1/2/01

53

only

666 m. 23 15 Very spread out,

right lower extremity

1st/2nd 01

Healed*). Since April or

single knots. 3rd, 6th 02:

No significant illness

appearances.
Significantly improved. To-

samine-hanging, deeply infiltrated
Affection. 1st/8th 02: Good Nar.
formation with distributed standing
the quite numerous node.

98

5th/2nd 01

223

Almost healed. 21/04/02: hands

free knots distributed on the arm.

668 sts. 25 20 large, 1st arm and

hand

7/2/01

97

662 M. 29 9 medium size, nose nasal cavity,

upper lip, r. Cheek upper lip 663 W. 48 37 Very spread out, nasal cavity,

664 m. 46 11

Gross, Nose, Ober

lip, both cheeks

nasal cavity,
upper lip,

gums,
palate, throat

nasal cavity

665 W.40

667 W. 45 40 Very spread out,

I. Arm and hand

669 w.41

I

Klein, I. Cheek

12./2. 01

24./5. 01 Healed*). 11./8.02 Letter: None

symptoms.
28.2. 01 Healed*).16.17.02: No.ill-

signs of heat, scar hardly
visible.

6

672 m. 25; 15 Very spread out,

right Cheek, Neck, I

Hand and Foot 673 W.21 17 Medium, left

670 v. 19

8 medium-sized, neck,

both hands

2/20/01

671 W. 20

8 medium,

Lips, 1st cheek

lips

22.2. 01

22nd, 2nd 01

2/23/01

cheek

674 W.63

4 Gross, nose, both

W:
Vangen

2/3/01

675 W.42

8 Small, nose

nasal cavity

5.3. 01

W 676 W. 19 18 large, both cheeks,

neck, r. poor

3/7/01

88

678 M. 26 10 Very spread out, nose bone, tooth 9.3. OT

Nose, upper lip, flesh, palate

both cheeks 679 W. 32 17 small, nose, upper nasal cavity, 9th/3rd 01 lip

palate

48

Significantly improved. to

related ulcerated affection. 12./3. 02: Partly good scarring, part ver

divides standing nodes.
18.7.01
01 Healed *). 3.4. 02: Beautiful

scar tissue, no disease

health symptoms.
Low impact. affect

tion has changed despite treatment

extended. (Tbc. pulm.)
11/25/01 Healed*). 19.17. 02: Beautiful

scar tissue, no disease.

health symptoms.

Healed*).

15th/7th 02: None

clear signs of illness.

ments.

1st/6th 01 UK disease. (Tbc. pulm.)

Significantly improved.

Almost healed. 9/1/02: Cheeks

free, only a few on the nose,

divides standing nodes.

681 W.45

1

12./3. 01

53

Partially healed. Since Dec 01:

partially good scar tissue,
only distributed Kuoten.

105

685 W. 54 16 Very expanded, nasal cavity, upper 3/20/01 nose, upper lip, at

lip, palate de cheeks, forehead

686 W.65 57 Small, Nose

nasal cavity

23./3.01

11

687 w.22

9 medium size, both gums, throat 23./3.01

cheeks, r. ob

17

17.17.01 UK Negative result.

(Hopeless case with connected, deep In

filtration.) Visibly improved. Almost healed. Spring 02:

A little burst from the

nasal cavity.
Died 13.'4.01 UK June oi at
Tbc.pulm.

Significantly
improves
18./6.01 Healed*). 14th/4th 02 letter :

No obvious illness

appearances.
Almost healed. Since July or only

few, distributed knots.

nasal cavity

688 W. 30 4 Gross, Nose, Upper

lip, both cheeks

23./3.01

62

97

689 M. 55 18 large, nose, upper nasal cavity, upper 27./3.01

lip, both cheeks, lip, palate

1. ear, throat

690 W.21

6 small, nose, 1st cheek, nasal cavity 29./3.01

Forehead

42

10/1/01 Healed*). 2nd/7th 02:

No

clear signs of illness

ments.

Almost healed. Since July oi only

few, distributed knots.

692 W. 40 27

206

2

big, nose, lips, nasal cavity,

3.4. 01 both cheeks, chin lips, gums

palate

Small, nose, upper nasal cavity 6.4. 01

lip

Large, nose, upper nasal cavity, dental 8.4. 01

lip, both cheeks flesh, gaunia

22

11/30/01 Healed*). 16.9. 02: Good

Scarring, not obvious

symptoms.
3.7. 01 Healed*). 5/4/02 Letter: None

symptoms.
Almost healed. 1.15. 02: Good

scar tissue, few spread

standing knots. Almost healed. Since July or only

few, distributed knots.

694 W. 25/ 16

193

693 W.12

Messages from Finsen's medical light institute.

695 m. 49 40

nasal cavity

4/10/01

75

Gross, Nose, Ober

lip, both cheeks, both arine

696 W.28 14

Almost healed. Irregular

Treatment. Since Sept. oi only
few, distributed standing knots.

28.7. 02: face free.
Healed*). I 3/2/02: None

symptoms.

109

7/12/01

V. VI.

697 W.'17 7

Gross, Vase, Lips, Lips, April 12, 01

right cheek, r. ear, gums

right hand, right Calf 698 M. 27 5 small, nose nasal cavity, dental 12. 4. OI

flesh, palate 699 W.32 4 Small, nose, 1st cheek nasal cavity

I 4/2/01

6

700W. 16'

2

149

Very expanded, nasal cavity, tooth. 4/20/01

Approx. 50 spots (i flesh, palate 2 cm each) all over the skin

24./10. 01 Healed *). 27./8. 02: None

symptoms. (TB.

pulp.)

29.4. 01 Healed *) 5./8. 02: None

symptoms.

Almost healed. 8th/4th 02: Right

Finger free since July oi, am

left a small wound.

3.6. 01 Healed *). 18th/10th 02: None

symptoms.

Healed*). Spring 02: smaller

eruption from the nasal cavity.

9th/7th 02 Letter: No sick

health symptoms.

Healed *). 18./9.02: No German

common symptoms.

706 m. 22

185

10 Very spread out, at the level of the nose

2./5.01

nose, both cheeks,

throat

7 medium-sized, nose, nasal cavity, upper 3.15. Oi

upper lip, both lip, gums,

cheeks

palate

707 M. 21

76

12./12. 01 Healed*). 31./7. 02: Good

Scar tissue, no clear signs of illness.

4.15.01

63

2nd/8th 01

710 m. 23 10 gross, nose, lips, nasal cavity,
both cheeks, chin lips, tooth

meat, palate
711 M. 46 36 Very spread out,

cheek, chin, neck
712 M. 56 20 Medium, left

Healed *), 17/21/02 Letter: None

symptoms.

Healed*). Since August on only

single knots. 18/9 02:

Nice scar tissue, none

symptoms.

Healed *). 6.7. 02: Good

scar tissue, no disease

health symptoms.

Significantly improved. advanced

set light treatment in the

Home (southern Russia).

Significantly improved. Early-year 02 small outbreak of

fresh knot. 3./9.02: Good

scar tissue, only a few

knots.

Almost healed. 19/7 02 letter:

Good scar tissue, just one

a few small scabs

lot.

Healed*). Winter 02: A few

small knots. 23/06/02: None

clear signs of illness

ments.

Healed *). 7th/9th 02: None

symptoms.

713 W. 29 28 Medium , l. hand

708 M. 27

3 small, nose

* 709 W.24

3 medium-sized, nose,

both cheeks, 1st ear

nose, upper lip, r.

cheek

714 W. 28

2 small, r. cheek

715 W.43 Small, Nose

*) See Plate XLVIII.

718 M. 36 20 medium size, nose, nasal cavity, tooth 21.5. 01
upper lip, both flesh, palate,

maw
I small, nose

nasal cavity 21./5. 01

cheeks

17.5. 01 Healed*). 30./4. 02: None

Signs of illness, hardly

visible scar. 19.17. 01 Almost healed. 7/10/02: Everywhere

good scar tissue, few

clear nodules.
Healed*). 10th/7th 02: None

clear signs of illness.

ments.
21./8. 01 Healed*). 17.4. 02: None

symptoms.

Healed*). 07/01/02: No German

common symptoms.

10/10/01 Almost healed. 7.5. 02 letter:

good scar tissue everywhere,

just a small one on the nose

Wound. (Tbc. pulm.)

14th/12th 01| Healed*). 15. 8.02 Letter: None

symptoms.

Healed*). 8/13/02: None

clear signs of illness.

ments

3rd/6th 01

154

18.9. 01 | UK disease. (Tbc. pulm.

gravis.) Visibly improved.

724 m. 44 30 Very spread out,

nose, upper lip, r.

cheek, r. Ear, Throat 10 Medium, Nose,

upper lip, r. cheek

726 W.151/2 medium-sized, nose, l.

Cheek, I. Arm 727 W. 19 1'/, Small, Vase

14 Small, Nose, Upper

8th/6th 01

165

02:

Healed*). Winter 02: smaller

Outbreak. 23./8. 02: None
clear signs of illness.

ments.
12/14/01 Healed*). 27./8. 02: None

symptoms.
16./9. 01 Healed*). 16./5.02 Letter: None

symptoms.
Healed*). winter

A
small knot on the upper
lip. 28./5.02: No illness

health symptoms.
Healed*). Since October or only

distributed nodes. 7.7.

02: Good scar tissue, none

clear signs of illness.

ments.

Almost healed. Irregular

Treatment. 24./6. 02: Good

scar tissue a small

Wound on the edge of the nostril.

14th/10th 01 Almost healed. 23./7. 02 letter:

Good scar tissue, a few

small knots. light treatment

in Stockholm,

10 Gross, nose, both

8th/6th 01

82

nasal cavity,
upper lip

730 W.1314), Small, Nose

nasal cavity

10.6. 01

40

725 W.18

728 m. 21

lip

729 W.50

cheeks

731 W.16

nasal cavity

6 small, nose, upper

lip, r. cheek

10th/6th 01

42

No.

gender age in year. Duration of illness in year.

expansion

and seat
of the skin condition

mucous membrane

lupus

treatment started

number of
individual

exposure
actions

1901

last treated

result

732 W8

53

1 Medium-sized, nose, nasal cavity, throat 11th/6th 01

upper lip, both
Wangen, I. Fuss

Almost healed. Irregular

treatment (coxitis). 17.2.02:
Only a few, spread out

Node.
7th/11th 01 Almost healed. 3rd/6th 02: Letter:

Good. scar tissue, few

dubious knots.

18/10, 01 Healed*). 11./2. 02: None

clear signs of illness.

ments.

27.17. 01 Healed *). 29./7.02 Letter: None

clear signs of illness

ments.

31./7.01 | Healed*). 1./4.02: No illness

health symptoms. (Tbc. pulm.)

14th/8th 01 Healed*). 1./10.02 Letter: None

symptoms.

Almost healed. Since Aug. oi only

few doubtful knots.

27.17. 01 Healed*). 2nd/8th 02: No German common symptoms. 7/3/01 Healed. 1./4.02: No sick

health symptoms.

82

4 large, nose, upper nasal cavity, upper 1.17.01

lip, both cheeks, lip, palate, 1st thigh

throat 1 small, r. cheek, 1

2nd/7.01 hand

30

741 wn

742 W.17

743 m. 61

744 W.41

745 m. 53

nasal cavity,

palate

9.7. 01

6 Gross, Nose, Upper

lip, both cheeks,
throat

103

Significantly improved. U.N

regular treatment (tbc.

pulp.?). 1st/10th 01 Healed*). 1st/9th 02: None

Signs of illness, hardly

visible scar.
18th/10th 01 Healed*). 14th/7th 02: None

symptoms.

22.8. 01 Healed *). Died March 02

of variola (in England).Sick

report no. 135
10/16/01 Significantly improved. 2nd/7th

02: The suffering has changed like-
therefore somewhat widespread (Tbc.

pulp.).
19th/10th 01 Healed*). 20th/5th 02 letter :

A small wound outside

the previously treated section.
Almost healed.

1.17. 02: Only
in 2 of the approx. 10 common ones
spots still doubtful

Node.

Healed*). Since Dec. OI

single knots. 13th/6th 02:

No signs of illness. 3rd, 10th 01

Healed*). 21./7.02 Letter: None

symptoms.

only

749 W. 29 18 Gross, r. hand and

poor

17.17.01

64

751 W.18

172

Healed*). Since Nov 01

isolated knots. 15th/7th 02:
Nice scar tissue, none

symptoms.
Partially healed. 10th/9th 02: ge

view and neck free, on the
Extremities partially good
Scar tissue, another part
Node,

Foot,

12 Very spread out, nasal cavity 19th/7th 01

nose, upper lip,
both cheeks, chin,
neck, both upper
extreme.,

1. sub
extreme.,

Body 752 W.17 2 large, nose, upper nasal cavity, 1.8. 01

lip, 1st cheek, throat, palate, pharynx,

both upper extremities.

throat

753 W.17

11 very spread out,

3rd/8th 01

1. Cheek, neck, r.

hand and arm

754 W. 50 3 small, nose, right

20./8. 01

cheek

755 W. 40 30|Large, nose, upper nasal cavity

21./8. 01 lip, both cheeks,

right Ear

21.,9. 01 Healed*). 25.17. 02:

No

symptoms.

22./11. 01 Healed*). 17th/5th 02: None

clear signs of illness.

ments (Tbc. pulm.). 27/9 01 Healed*). 27./8. 02: None

clear signs of illness.

19/11 01 Healed*). 25.17. 02: None

symptoms.

31/10, 01 Almost healed. 5th/7th 02: R

Cheek free, on the nose and

1. cheek few spread ste-

existing knots.

Almost healed. Irregular

treatment

Since Nov 01

only a few distributed standing

Node.

756 W. 16

8 large, r. poor

22./8. 01

nasal cavity

757 W. 54 18 Gross, Nose, Upper

lip, both cheeks

23./8. 01

nasal cavity

24./8. 01

26.8. 01

758 W. 21 15 Medium, both

Cheeks, neck 759 W. 19 17 Very spread out,

Nose

e, upper lip, both cheeks, forehead,

right ear, chin, neck
760 W. 30 Small, Nose

nasal cavity,
upper lips

nasal cavity

27./8. 01

761 W.44 17 small, nose, upper nasal cavity, tooth 27./8. or lip

meat, palate

762 W.71

3 small, nose, r. cheek

nasal cavity

27./8. 01

763 m. 13

nasal cavity

28.8. 01

1 small, nose, upper

Yippee
20 medium-sized, nose,

both cheeks

764/W.52

nasal cavity

29./8. 01

29./8. 01

765 W.39 27 large, nose, lips,

both cheeks

nasal cavity, lips, palate

770 W. 17 2'), medium-sized, nose,

upper lip, r. Cheek,

throat

771 m. 34 27 Medium, left

cheek and ear,

neck, r. Arm 772 W.33 17 Small, Nose

6th/9th 01

nasal cavity

11.9. 01

773 m. 11

4 Klein, I. Cheek

18/9 01

17

leg

1 medium-sized, nose,

only

Significantly improved. U.N

regular treatment. 26./9.

02: Cheeks free, otherwise only

few, spread out standing. Node.

Healed *). Since Dec. ou

few knots. 30./9. 02:

No clear disease

appearances.

29/10 01 Healed*). 2./7.02: No German

common symptoms.

1st/11th 01 Healed*). 5th/9th 02 Letter: None

clear signs of illness.

ments. 9/12, 01 Healed*). 28./05.02 Letter: None

clear signs of illness.

ments.

8th/10th 01 UK Died. 17th/6th 02

of tuberculosis pulm. duplicate essential

slightly improved. 8th/5th 02 letter:

Only insignificant blush and

peeling.

23

nasal cavity

26.9. 01

774 W.10

8 small, l. hand

775 W.17 16 small, nose, upper

lip

776 m. 37 20 Very spread out,

Nose. upper lip,

both cheeks, forehead,

Chin, neck, both

upper lip, both

cheeks, r. leg

777 W. 12

778 W. 10

2 small, nose, upper

lip

779 W.27

11 Small, chin

780 W.27 24 Small, 1st cheek

781 W. 28

20 small, nose, upper

lip

782 W.18

1|Small, nose

Nasal cavity, throat 27.9. Oi

9

2nd/12th 01 Healed*). 21./8. 02: None

clear signs of illness.

ments

A small nodule

outside the built-up area. lot.

Significantly improved. Since

Dec 01

only a few, distributed

standing knots.

Healed*). irregular loading

plot. 9.8.02 Letter: None

clear signs of illness.

ments.

Almost healed. Since Dec 01:

nose free. 9/9 02: Only one

few dubious knots.

Significantly improved. U.N-

regular treatment. 2nd/6th

02: Partly good scar

tissue, on lobule some

nodules.

Healed"). None as of Feb 02

clear signs of illness

ments.

789 m. 39 30 large, nose, upper nasal cavity,

lip, both cheeks palate, throat

12.'10. 01

76

Significantly improved. Since Dec 01

only a few doubtful knots.

we

12

8th

Large, nose, upper vase cavity, upper 22. 10. 01

lip, both cheeks, lip, gums, r. poor

throat

N

ncave

4/11/01

43

Almost healed. Since Dec. OI

only a few small knots. 8.17.
02: Good scar tissue, a

single node (Tbc. pulm.).
Almost healed. 4.17.02: Everywhere

good scar tissue, only

few dubious knots.

Almost healed. treatment from

30., 10.01 --2.7.02 cancelled.

1./9.02: Few doubts.

knots (Tbc. pulm. dupl.

cavern.).

Almost healed. Since Dec. or only

single small knots.

hey*). None since Feb 02

clear signs of illness.

ments.

Almost healed. Since Dec. or only

single dubious knots,

Healed *). None since May 2002

clear signs of illness.

ments. Almost healed. Irregular

treatment

1 small, nose, left

Cheek, Throat 7 Small, Nose

nasal cavity

4.II, 01

63

792 W.22

793 m. 16

794 W'. 48

795 W.34

796 W.15

dental flesh

11/7/01

47

cheeks

nasal cavity

797 W. 30 24 medium, nose,

upper lip, 1st wa

arrived

9.11. 01

I 2

798 W. 44

3 medium-sized, nose

nasal cavity

13./11. 01

nasal cavity,

lips

19/11/01

799 W.14 14 Very spread out,

nose, upper lip,
both cheeks, chin,
neck, 1st obr, 1st ob-
right eyelid

800 m. 21

21./11. 01

7 Very expanded, nasal cavity,

Nose, upper lip, two- lips, teeth, cheeks, chin, flesh, palate throat, I. thigh

Almost healed. 12.17.02: Everywhere

good scarring, few,
distributed standing nodes (Tbc.
pulp.).

medical reports.

Medical report no. 1.

No. 1. MG*), 46 years, Copenhagen.

no tub in the family; Patient himself earlier healthy. lup. vulgar on the left cheek for 8 years, progressive growth despite vigorous surgical treatment: thermocaustic, scraping, transplantation (in all more than 30 chloroform anesthetics).

20 Nov 95. Healthy appearance. On the right cheek, a lump of lupus the size of a child's hand, scar tissue in places with numerous nodules.

Medium case.

light treatment. 20 Nov 95 to 1 Apr 96 (ca. 4

Months).

October 96, a nodule the size of a pea remains.

Light treatment (few séances). No symptoms of illness since October 1996. Last checked on 1 Jul 02. Smooth scar tissue, the graft flap stands out very conspicuously.

Medical report no. 2.

No. 15

Shared flat, 21 years old, Copenhagen. no tub in the family; The patient himself was ailing as a child (eye problems, anaemia).

*) MG means male gender, WG female gender.

lup. vulgar of the nose for 7 years, starting from the nasal cavity, slow growth. Irregular treatment in the past: scraping and thermocaustic without any particular effect

16 Dec 96. Healthy appearance. The skin over the cartilaginous part of the nose is swollen, red and shows typical nodules; small defect on the right nostril. - Small case. — Nostrils severely narrowed, mucosal affection healed.

Intermittent light treatment 16 Dec 96

to July 8, 97 (98 séances). March 17, 1998. On the tip of the nose a lump the size of a hemp seed and covered with scabs.

Light treatment March 17 to June 13, 1998 (25 séances). No symptoms of illness since June 98. Last checked 30 Aug 02. Little visible scar tissue, defect as before treatment.

Medical report no. 3.

No. 19 flat share, 6 years, Copenhagen.

no tub in the family; Patient himself earlier healthy. lup. vulgar right cheek since 2 years; 3 times treated with scraping; temporary improvement.

15-Jan-97. Healthy appearance. On the right cheek a scarred spot (1 x 1.5 cm) with 3 typical knots. small case.

Temporarily interrupted light treatment 15 Jan to 13 Sept 97 (8 séances).

No symptoms of illness since Sept. 97. Last inspection June 1900; barely visible scar.

Medical report no. 4.

Vo. 22

Shared flat, 30 years, Jylland (city). no tub in the family; Patient himself healthy on the whole. lup. vulgar for four and a half years, treated only with ointment.

18-Jan-97. Healthy appearance. On the nose quite significant defect of the apex, swelling, continuous wound (3 x 3 cm) with lumps in the area.

Medium case. – Mucosal affection in the nasal cavity has essentially healed with a large defect in the cartilage septum (never treated).

Light treatment 18 Jan to 4 Jul 97 (140 séances). On the mucous membranes:

sublimated tampons.

Feb. 24, 1998. Scarring in places, small wounds on both anterior corners of the nostrils.

Light treatment February 24th to June 22nd and October 13th

to 3 Dec 98 (134 séances). Since Des. 98 no symptoms of illness. Last checked June 7, 1900. Smooth scar tissue, natural color, only slightly disfiguring the old defect. letter and Aug. 02.

Mucosal affection healed.

Medical report no. 5.

No. 30th MG, 25 years, Fyen (land).

no tub in the family; Patient had a scrofulous ear and eye condition.

lup. vulgar for 23 years, beginning on the throat, shortly after vaccination. 10 years ago the nose and both cheeks were seized; - slow growth. Surgically treated for a few years (thermo-caustic, excision and transplantation), then tuberculin, in recent years only lapis pencil. Messages from Finsen's medical light institute.

10

v, vi

April 1, 97. Healthy appearance. Affected are the nose (rather large defect, scar tissue with lumps) and right cheek (3X3 cc with numerous lumps). A knotless scar on the left cheek and neck. – Medium-sized case.

In the nasal cavity, the mucosal affection has healed.

Light treatment April 1 to June 11, 1997 (107 séances). No symptoms of illness since June 97. Last checked 15 Jun 02. Scars hardly visible after light treatment.

Medical Report #6.

No. 34, WG, 23 years, Copenhagen.

no tub in the family; Patient herself always healthy.

lup. vulgar the nose for 61/2 years; repeatedly treated with Tkermokaustik, excision, and transplantation.

May 11, 97. Good looks. Affected are the nose (major defect, scar tissue with numerous nodules) and upper lip (few nodules). small case.

In the nasal cavity, the mucosal affection with a defect in the cartilage septum has healed.

Light treatment 1 May to 7 Sept 97 (73 séances). No symptoms of illness since Sept. 97. Last checked 18 Nov 02: Smooth, white scar tissue, defect as before treatment (wears prosthesis).

I

Medical report no. 7 (see Plate I).

No. 40th MG, 20 years, Jylland (Land).

mother to tub. pulp. died; patient previously healthy.

lup. vulgar for 11 years; Beginning on the nose, slow growth, little treatment in the past.

June 8, 1997. Fairly healthy appearance. The nose with a significant defect, the entire upper lip, both cheeks (approx. 3 cm) are affected. Lupus hypertrophicus and ulcerosus. big case. mucous membrane of the nose seized widely; Defect in Sept. cartilag.

Light treatment June 8, 97 to June 20, 98 (302 séances). On the mucous membranes:

Sublimattemp., Iodine-Iodinepotassium, Galvanocaustic.

7 Nov 98. Nice scar tissue with isolated, partly ulcerative nodules; constant ulcerations on the nasal mucosa.

Temporarily interrupted light treatment until

28 Aug 99 (55 séances). Scit Aug. 99 no symptoms of illness. Last checked on Aug. 13, 2002: little visible scar tissue, nose defect quite significant.

Mucosal affection healed.

Medical report no. 8th.

No. 41st MG, 15 years, Jylland (Land).

no tub in the family; patient previously healthy.

lup. vulgar since 3 years, starting from the nasal mucosa, quickly spread to the left side of the nose and upper lip, as well as the left cheek; earlier treatment only slightly energetic.

June 9, 97. Healthy appearance. In connection, the left side of the cartilaginous nose, the left half of the upper lip and the left cheek (2-3 cm) are affected. Scaling knots everywhere, small defect in the left nostril.

Medium case. Isolated nodules on the nasal mucosa on the left.

Light treatment June 9th to September 9th '97 (80 séances). 20 Feb 99. Small eruption of fresh nodules. Intermittent light treatment 20 Feb to 26 Jun '99 (46 séances).

On the mucous membranes:

Sublimattemp., Iodine-Iodinepotassium, Galvanocaustic. No symptoms of illness since June 99. Last checked on Nov. 11th, 2002: Smooth scar tissue, defect in the nasal ala is barely visible.

The mucosal affection almost healed.

Medical Report #9.

No. 45th MG, 25 years, Själland (city).

Family background and previous health unknown.

lup. vulgar of the nose for 1/, years; not treated earlier.

July 6, 1997. The nose is affected: a knot the size of a hemp seed on the underside of the septum. small case.

Temporarily interrupted light treatment July 6 to

13 Dec 97 (6 séances). No symptoms of illness since Dec. 97. Last checked 17 Oct 99. Barely visible scar.

Medical report no. 10

No. 46th MG, 20 years, Copenhagen.

no tub in the family; patient previously healthy.

lup. vulgar both ears for 4 years; previously treated with ointment and ignipuncture.

July 27, 1997. Healthy appearance. The edges of both ears are seized with some loss of substance and a few small knots. small case.

Light Treatment 27 Jul to 25 Sept 97 (5+ séances).

Mar. 12, 1998. Good scar tissue on right ear, but two distinct lumps on left.

Intermittent light treatment March 12th

to July 7, 98 (48 séances).

No symptoms of illness since July 98. Last checked 12 Jul 99: Smooth scar tissue. letter 7 Aug 02

Medical report no. 11.

No. 50. WG, 39 years, Faroerne.

no tub in the family; Patient scrofulous as a child.

lup. vulgar for 29 years; starting from nasal cavity, slow growth over nose and both cheeks; earlier vigorous treatment (mainly scraping and caustic ointments) with local healing:

9 Sep 97. Healthy appearance. In connection, the nose and both cheeks are affected in a large spread; Scar tissue with numerous nodules, fairly significant defect in the nose. big case.

Light treatment 9 Sep to 10 Dec 97 (76 séances). No symptoms of illness since Dec. 97. (A small spot on the right cheek outside the previously treated area received light treatment 8 séances in 1901.) Last checked on Sept. 1, 02: good scar tissue everywhere.

Medical report no. 12.

No. 55th MG, 32 years, Copenhagen.

mother to tub. pulp. died; Patient scrofulous as a child.

lup. vulgar for 20 years; started on the nose, slowly spreading to the left cheek; 7 years ago treated with tuberculin, the last 2 years treated with ignipuncture with little effect.

27 Sep 97. Appears fairly healthy. Left half of the nose and the closest part of the left cheek seized: scaly nodules, small defect on the edge of the left nostril. small case. Isolated nodules in the nasal cavity and large perforation in the septum. maxillary gums seized.

Light treatment 27 Sep to 26 Nov 97 (53 séances). 8 Feb 98.

Good scar tissue with two or three small knots.

Light treatment 8 Feb to 9 Mar 98 (14 séances). On the mucous membranes:

Sublimattemp., Iodine-Iodinepotassium, Galvanocaustic. No symptoms of illness since March 98. Last checked on Nov. 8th, 2002: Little visible scar tissue, defect as before the treatment.

Mucosal affection almost healed.

Medical report no. 13.

The whole

No. 59. WG, 43 years, Fyen (city).

Father at Tub.pulm. died; Patient. scrofulous as a child.

lup. vulgar of the nose for 2 years, slow growth; early minor treatment: 9 Oct 97.

Fairly healthy appearance. Skin over the cartilaginous part of the nose is swollen and shows partially connected nodules. small case. - Scattered nodules in the nasal cavity.

Intermittent light treatment 9 Oct 97

to 30 Nov 98 (159 séances). On the mucous membranes:

Sublimattemp., Iodine-Iodinepotassium, Galvanocaustic. 2 Aug 99

Nice scar tissue, in which two small knots.

Light treatment Aug 2 to Aug 5 99 (5 séances). No symptoms of illness since Aug. 99. Last checked Nov.18: Little visible scar tissue, no defect. Letter 12 Aug 02

Mucosal affection almost healed.

Medical report no. 14

No. 64

Flat share 17 years, Jylland (Country). A sister to Tub. pulp. died; Patient previously healthy.

lup. vulgar since 5 years, started on right cheek, progressive growth; left cheek recently seized; previously treated homeopathically.

22 Oct 97. Healthy appearance. Right cheek (connecting knots 4X4 cm) and left cheek (a scar with a pea-sized knot) seized. Medium case.

Intermittent light treatment 22 Oct 97

to 29 Oct 98 (152 séances). 8 Jan 99. Nice scar tissue with scattered knots.

Light treatment 9 Jan to 6 Feb 99 (23 séances). No symptoms of illness since February 1999. Last checked 5 Mar 02: scars barely visible.

Medical report no. 15

No. 70

Shared flat, 6 years, Jylland (Country).

no tub in the family; Patient scrofulous.

lup. vulgar the nose for 10 years, slowly growing; treated vigorously with galvano-caustic in the last 3 years with little result.

5 Nov 97. Healthy appearance. The skin over the cartilaginous left part of the nose is affected: numerous, partially ulcerative nodules, small defect in the edge of the nostril. small case. - Left nostril narrowed, mucous membrane free.

Intermittent light treatment 5 Nov 97

to 15 June 98 (148 séances).

Oct. 3, 1998. Single lumps on the nose, as well as the upper lip and right cheek (new affection). Scattered nodules in the nasal cavity.

Light treatment 8 Oct to 5 Dec 98 (25 séances). On the mucous membranes:

Sublimattamp., Jod-Iodkali.

March 13 oo. Nose, upper lip free, 5 small knots on the right cheek.

Light treatment March 13 to April 7 oo (u séances). No symptoms of illness since April oo. Last checked on July 2nd: Little visible scar, defect only small. letter 8 Jun 02

Mucosal affection healed.

Medical report no. 16 (see Plate III).

No. 74th MG, 19 years, Sjaelland (Land).

no tub in the family; Patient as a child skrofulós.

lup. vulgar for 13 years; Starting from the nasal cavity, it slowly spread to the nose, upper lip and, in recent years, both cheeks. Previously untreated.

16 Nov 97. Healthy appearance. The nose is significantly swollen, reddened, shows numerous nodules, defect and ulceration of the right nostril border; the affection extends over the right half of the upper lip and about 10 cm to the right cheek; on the left cheek a knotty area the size of two pennies. big case. Ulceration widespread in the nasal cavity, also on the mucosa of the upper lip and gums. tear duct affection.

light treatment 16 Nov. 97 to 21 Dec. 98 (320 séances). On the mucous membranes:

Sublimattemp., Iodine-Iodinepotassium, Galvanocaustic.

No symptoms of illness since Dec. 98. Last February 13 oi checked: scar tissue little visible, defect as before treatment.

Mucosal affections almost healed.

Medical report no. 17

No. 75. WG, 33 years, married, Lesó (countryside).

no tub in the family; Patient scrofulous as a child.

lup. vulgar since 7 years; started on the nose, slowly spread to both cheeks. Treated vigorously with lapis pencil, caustic ointment and scraping; only temporary improvement.

2 Dec 97. Healthy appearance. The nose and adjacent part of both cheeks affected: numerous flat nodules, some scar tissue, minor defect of the left nostril. Medium case. -- Nostrils narrowed. In the

nasal cavity the mucosal affection has healed; Isolated ulcerations on the gums of the upper jaw. tear duct affection.

Light treatment 2.Dec. 97 to 12 Feb. 98 (71 séances).

May 27, 1999. Nice scar tissue with a few isolated lumps.

Light treatment May 27 to July 12, 1999 (38 séances). On the mucous membranes:

Potassium iodine, galvanic caustic. No symptoms of illness since July 99. Medical control at home. Last letter 19 Aug 02.

Medical report no. 18

Vo. 8o. Shared apartment, 26 years old, married, Zealand (country).

no tub in the family; Patient previously healthy.

lup. vulgar of the nose for 9 years, starting from the nasal cavity. Treated once with scraping. Recurrence after 3 years.

10 Dec 97. Healthy appearance. The whole skin over the cartilaginous part of the nose is affected when there is a significant swelling, and shows numerous nodules; Ulceration of the right edge of the nostril. collapse of the nasal septum. small case. -- Nostrils severely narrowed, vestibule and mucous membrane swollen, ulcerated.

Light treatment 10 Dec 97 to 4 Aug 98 (88 séances). On the mucous membranes:

sublimatamp.

3 May 99. Right edge of nose ulcerated with surrounding lumps.

Light treatment May 3rd to June 3rd '99 (25 séances). On the mucous membranes:

Sublimattemp., Galvanocaustic.

No symptoms of illness since June 99. Last Oct 18

02 checked: nice scar tissue, tip of nose

fall, nostrils narrowed.

Mucosal affections healed.

Medical report no. 19

No. 81. WG, 22 years, Jylland (city).

no tub in the family; Patient previously healthy.

lup. vulgar of the nose for 6 years, slow growth; repeated vigorous treatment (scratching, cauterization) with temporary improvement.

10 Dec 97. Healthy appearance. The skin over the cartilaginous part of the nose is red, swollen, and has lumps. small case. Ulceration in the nasal cavity, large perforation in the septum cartilage.

light treatment 10 Dec 97 to 10 Mar 98,

14 April to 11 June 98 (130 séances).

On the mucous membranes:

Sublimattemp., Iodine-Iodinepotassium, Galvanocaustic. 28 Nov 98. Few isolated knots. Light treatment 28 Nov 98 to 9 Jan 99, 20 Feb

to April 5, 99 (53 séances). On the mucous membranes:

like in old times. No symptoms of illness since April 99. Last Feb 7th or checked: Solid scar tissue. Letter 21-Nov-02.

Mucosal affection almost healed.

Medical report no. 20

No. 85th MG, 24 years, Jylland (city).

no tub in the family, patient as a child cervical gland tumor.

lup. vulgar since 9 years, started on left cheek, quickly spread to nose and right cheek; vigorously treated with cauterization 5 years ago; temporary improvement.

5 Jan 98. Healthy appearance. Grabbed the nose and the part of both cheeks closest to it; scar tissue with isolated nodules and erosions; significant defect and collapse of the soft nose. Medium case. - Nostrils greatly narrowed, mucous membrane apparently free. tear duct affection.

Light treatment Jan 5 to Jun 5, Jul 13 to

21 July 98 (140 séances). April 5th 99: Some fresh knots on the nose. Intermittent light treatment April 5th

to June 23, 99 (24 séances). 21 Jan and 8 May 1900: A few knots on the nose. Light treatment Jan 22 to Jan 26, May 8 to

May 12, 1900 (15 séances).

No symptoms of illness since May 1900. Medical control at home. Last letter 29 Sep 02.

Medical report no. 21

No. 86th MG, 11 years, Sjælland (Land).

no tub in the family; Patient cervical gland tumor and discharge in the ears. lup. vulgar the nose for 3 1/2 years; repeated opera

3 tive treatment (partial removal of the left nostril) with temporary improvement.

7 Jan 98. Healthy appearance. The tip of the nose and the left nostril are affected with numerous nodules, large defect in the nostril. small case.

Light Treatment Jan 7th to March 8th, June 15th,

18 June 98 (53 séances).

May 26, 1999: About 10 nodules in total.

Light treatment May 26 to June 13, 1999 (14 séances). No symptoms of illness since June 99. Last checked 23 Sep 02: solid scar tissue, defect as before treatment

Medical report no. 22 (see Plate IV).

No. 87th MG, 11 years, Fyen (city).

no tub in the family; patient scrofulous.

lup. vulgar since 2 years, started on the nose, quickly extended to the upper lip and both cheeks; treated with ointment, lapis and scraping without success.

& Jan 98. Poor appearance; Cervical gland tumour, discharge in the ears, keratoconjunctivitis. In connection, the skin over the cartilaginous part of the nose, the upper lip, and large portions of both cheeks are affected; ulcerative, destructive affection. big case. The mucous membranes of the nasal cavity and upper lip are involved.

Light treatment Jan 11, 98 to Jan 19, 99

(251 séances). On the mucous membranes:

Sublimattemp., Iodine-Iodinepotassium, Galvanocaustic.

1899-1900. Only a few knots on the skin; ongoing treatment of intractable mucosal disease.

Temporarily interrupted light treatment until Sept. 19

1900 (45 séances). No symptoms of illness since Sept. oo. Last checked on Aug. 29, 2001: Smooth, beautiful scar tissue, nose defect as before the treatment. Letter 13 Aug 02

Mucosal affection almost healed.

Medical report no. 23

No. 94th MG, 8 years, Sjælland (Land).

mother to tub. pulp. died; patient scrofulous.

lup. vulgar right cheek for 8 years, slow growth; previously only ointment treatment, without success.

Jan 31, 1998. Appears fairly healthy, cervical glandular mass. The right cheek is affected: a patch, 3 x 2 cm, with deep infiltration and numerous nodules. small case.

Temporarily suspended light treatment Jan 31

to 14 Oct 98 (87 séances). 18 Dec 98. A few nodules.

Light treatment 18 Dec to 20 Dec (5 séances). 1 2 Feb 00. Four small knots. Temporarily interrupted light treatment until March 23rd

00 (8 séances). No symptoms of illness since March oo. Last checked Aug. 18, 2002: Smooth, barely visible scar.

Medical report no. 24. (Plate VI). No. 104. WG, 22 years, Langeland (Country).

tubes in the family; Patient previously healthy.

lup. vulgar since 6 years, started on the nose and spread quite quickly to the upper lip and both cheeks; treated vigorously with repeated scrapings and three times with excision and transplantation, with temporary success.

12 Feb 98. Healthy appearance. The entire nose and upper lip, as well as the part of both cheeks closest to them, are affected. Ulcerative, destructive affection. big case. Affection of the mucous membrane in the throat.

Light treatment 19 Feb to 18 Aug 1998 (152 séances).

15 Nov 98. Few isolated knots. On Prolab. great a big wound.

Temporarily interrupted light treatment 15.Nov.98

to Jan 20 '99, May 3 to Jun 30 '99 (as a whole

45 séances). To the wound on Prolab.:

Double scraping. No symptoms of illness since June 99. Last checked on Aug. 18, 2000: Smooth, beautiful scar tissue, defect as before treatment. Letter May 2, 2002. Mucosal affection healed spontaneously.

Medical report no. 25

No. 108. WG, 27 years, Jylland (country).

no tub in the family; Patient previously healthy.

lup. vulgar since 7 years; starting from the nasal cavity, growing slowly over the nose; In recent years, affections on the chin, right ear, and left arm: constantly treated with scrapings and caustics with little success.

Feb. 24, 1998. Fairly healthy appearance.

The skin over the cartilaginous part of the nose is swollen, showing lumps and ulcerations; on the chin a scar, in which two nodules, on the edge of the right ear a pea-sized knot-like area and on the left arm a two-penny-sized knot-like area. - Medium sized case. - In the

. nasal cavity extensive mucosal affection with large perforation in the septum cartilag.; Lupus quite extensive on the hard palate.

Light treatment 24 Feb to 21 Jul 98 (129 séances). On the left arm:

Pyrogall Ointment. On the mucous membranes:

Sublimattemp., Iodine-Iodinepotassium, Galvanocaustic.

Nov. 4, 1998. Nose and chin free, a few nodules on the right ear and left arms.

mucous membranes improving.

Light treatment 1 Nov to 14 Nov 98 (10 séances).

(June 8, 1999. Some fresh nodules on nose and ear; on prolab. sup. a pea-sized ulceration. Progressive improvement of mucous membranes.

Light treatment June 8th to July 27th '99 (43 séances). Jan 26 oo.

A few knots again on the nose and right ear; Chin, left arm, prolabium and palate free; only isolated nodules in the nasal cavity.

Intermittent light treatment Jan 26

to April 26 oo (45 séances). To the nasal cavity:

Like in old times. No symptoms of illness since April oo. Medical control at home. Last letter 29 May 02.

No. 117

Medical report no. 26

Shared flat, 21 years, Jylland (Country).

no tub in the family; Patient previously healthy.

lup. vulgar since 10 years, started on the nose, slow growth after upper lip and right cheek; previously little treatment.

14 Mar 98. Healthy appearance. All the skin over the cartilaginous part of the nose is swollen, numerous nodules and significant defect of the right nostril; Lupus extends over the right half of the upper lip and about 3 cm to the right cheek with numerous nodules. Medium case. - In the nasal cavity isolated nodules and perforation in the septum cartilage.

light treatment March 14 to Aug. 15, 1998 (131 séances). On the mucous membranes:

Sublimattemp., Galvanocaustic.

23 Feb 99: Nice scar tissue, 7-8 nodules in all. Nasal cavity almost healed.

Light treatment March 23 to April 6, 1999 (30 séances). No symptoms of illness since April 99. Last August 30th oi checked: scar tissue little visible, nose defect as before treatment. letter 6 Jun 02

Mucosal affection healed.

Medical report no. 27. (Plate VII.) No. 124th MG, 17 years, Jylland (city).

no tub in the family; Patient with early ear discharge and ostitis ulnae.

lup. vulgar since 4 years quite rapid growth, starting from the nasal cavity, over the nose and onto the right cheek; repeated scrapings with temporary success.

Mar. 22, 1998. Healthy appearance. The skin over the cartilaginous part of the nose is swollen, showing lumps and ulcerations; on the right cheek two ulcerations, the size of a penny. - Medium sized case. - Extensive affection in the nasal cavity with perforation of the cartilage septum; soft palate with uvula and throat gripped.

light treatment March 22 to Aug. 22, 1998 (126 séances). On the mucous membranes:

Sublimattemp., Iodine-Iodinepotassium, Galvanocaustic. No symptoms of illness since Aug. 98. Last checked on July 8th: Nice, little visible scar tissue. Letter 13 May 02

Mucosal affection healed.

Medical report no. 28

No. 128. WG, 4 years, Copenhagen.

father to tub. pulp. died; Patient has a tendency to cough.

lup. vulgar left cheek for 3 years; never treated.

April 4, 1998. Looks pretty healthy, cervical glandular tumor. The left cheek is affected: a rounded spot of 3 cm, flat, with numerous nodules. small case.

Light treatment April 4 to July 2, 1998 (57 séances). No symptoms of illness since July 98. Last checked Sept. 23, 2002: Hardly visible scar tissue.

Medical report no. 29. (Plate VIII.) No. 133rd MG, 20 years, Jylland (city).

5 siblings tuberculous; patient previously healthy.

lup. vulgar for years, starting from deeper scrofula on the neck, it quickly took hold of both cheeks, lips and nose, later right elbow and left thigh.

April 28, 1998. Healthy appearance. cervical gland tumor. In connection, the whole nose and upper lip, lower lip and both cheeks are affected in a large spread; Messages from Finsen's medical light institute.

significant infiltration, coherent nodules and ulcerations, fairly large soft nose defect. On the right elbow a roundish area covered with scab, about 3 cm, on the left thigh a similar affection. Very widespread case. Very extensive affection in the nasal cavity with large perforation in Sept. cartilag.; affected the mucous membranes of the lips, gums and palate. tear duct affection.

light treatment 28 April 98 to 6 July 99 (303 séances).

Pyrogall Ointment. On the mucous membranes:

Sublimattemp., Iodine-Iodinepotassium, Galvanocaustic. No symptoms of illness since July 99. Last checked 1 Oct 02: Nice soft scar tissue all over. Nose defect as before treatment.

Mucosal affection healed.

Medical report no. 30 (Plate X).

on

No. 141, flat share, 30 years, married, Jylland (city).

mother tub pulp. died; Patient formerly scrofulous.

lup. vulgar since 15 years, starting from the nasal cavity, slow growth over the nose, upper lip and both cheeks. 7 years ago vigorous treatment with scraping and thermocaustic without success.

June 1, 98. Healthy appearance. Affected are the whole nose, upper lip, large areas of both cheeks, with swelling, redness and connected nodules covered with scabs. Minor defects on both nostrils. - Very widespread case. - In

. affections spread through the nasal cavity. tear duct affection

Light treatment June 1 to Oct. 29, 1998 (131 séances).

On the mucous membranes:

Sublimattemp., Iodine-Iodinepotassium, Galvanocaustic. No symptoms of illness since Oct. 98. Last checked Oct. 1, 2002: Nice scar tissue everywhere, not very obvious; Nose defect as before treatment.

Mucosal affection almost healed.

Medical report no. 31. (Plate XI). No. 143. WG, 43 years, married, Sónderjylland (Country).

Father'an Tub. pulp. died; Patient previously healthy

lup. vulgar since 19 years, originating in the nasal cavity, has been limited for a long time, has spread over the nose, to the upper lip and both cheeks in the last year. Little treatment.

June 2, 98. Healthy appearance. All the skin over the cartilaginous part of the nose is swollen, ulcerated, and shows fairly important defects; the adjacent part of the upper lip and both cheeks is red, swollen with scattered nodules. - Medium sized case. – In the nasal cavity almost healed affections with large perforation in Sept. cart. tear duct affection.

Light treatment July 2nd to November 2nd '98 (132 séances).

July 21, 1900: Nice scar tissue everywhere. A few nodules on the right cheek outside the previously treated area.

Light treatment June 21 to June 30 oo (9 séances). No symptoms of illness since June oo. Last 25th junior checked: Nice scar tissue. Defect as before treatment. Letter Aug. 27, 2002. Mucosal affection healed.

Medical report no. 32. No. 144. W.G, 62 years old, married, Jylland (Country).

no tub in the family; Patient previously healthy. lup. vulgar since 8 years, started on right cheek, slow growth; 4 years ago the nose and the third finger of the right hand were seized at the same time. Previously little treatment.

June 3, 98. Healthy appearance. The whole nose is red, swollen and shows numerous nodules; small defect of both nostrils. A scar in the middle of the right cheek, in which two nodules; on the third finger of the right hand a fairly large affection with numerous nodules. Medium case. - Extensive affection in the nasal cavity with large perforation in Sept. cart. tear duct affection.

Light treatment June 3rd to Sept. 3rd, Oct. 18th to

3 Nov 98 (123 séances). On the mucous membranes:

Sublimattemp., Galvanocaustic. June 21, 1900. Nice scar tissue, a small lump.

Light treatment June 21 to July 2 oo (8 séances). No symptoms of illness since July oo. Medical control at home. Last letter 5 July 02.

Mucosal affection not completely healed.

Medical report no. 33. No. 147. WG, 8 years, Copenhagen.

no tub in the family; Patient previously healthy.

lup. vulgar left cheek for 2 years; little treated.

June 15, 1998. Healthy appearance. The left cheek is affected: a patch, 2 X 1 cm, flat, with numerous nodules. small case.

Light treatment June 15 to Aug. 12, 1998 (26 séances). No symptoms of illness since Aug.98. Last checked Aug. 30, 2001: Little visible scar tissue. Letter 1. Vor.02.

Medical report no. 34

No. 159

Shared flat, 18 years, Copenhagen. no tub in the family; Patient previously had ear problems and hip joint inflammation.

lup. vulgar for 10 years, originating in the nasal cavity, has spread through the nose and somewhat to the left cheek, despite vigorous treatment with scraping, cauterization, caustic ointments (2 years in a coastal hospital).

June 29, 1998. Fairly healthy appearance. The skin over the cartilaginous part of the nose is swollen, shows numerous nodules, small defect of the nostrils. A pea-sized knot on the left cheek. - Medium sized case.

In the nasal cavity the affection is almost healed with a large perforation in Sept. cart.

Light treatment June 29, 98 to January 10, 99

(134 séances). On the mucous membranes:

Sublimattamp., Jod-Iodkali. No symptoms of illness since January 1999. Last June 1 oi checked: little visible scar tissue, nose defect as before treatment. Letter 22 June 02.

Mucosal affection healed.

Medical report no. 35

No. 162. WG, 27 years, Jylland (country).

father to tub. pulp. died; Patient previously had a cervical gland tumor, kyphoscoliosis.

lup. vulgar for 8 years, has slowly spread from the nasal cavity through the nose. Previously only a single scraping with little success.

July 5, 1898. Morbid appearance. The skin over the cartilaginous part of the nose with scars is affected

tissue, single nodes and erosions; quite significant defect. small case. -- Isolated nodules in the nasal cavity. tear duct affections.

Light treatment July 5 to September 5, 98 (55

séances).

On the mucous membranes:

Sublimattamp., Jod-Iodkali

. A single knot in the spring of 1900, treated in-house with galvano-caustic.

No symptoms of illness since the spring of 1900. Medical control at home. Last letter 28 Aug 02.

Mucosal affections healed.

Medical report no. 36

No. 163

Shared flat, 17 years, Jylland (city). A brother to Tub. pulp. died; Patient previously healthy.

lup. vulgar since 21/2 years, started on the nose, later a spot above the left eyebrow, on the left corner of the jaw and on the right arm. Previously little treatment.

5 Jul 98. Healthy appearance. Disseminated affection: On the left side of the tip of the nose about 10 nodules, above the left eyebrows a spot the size of a good pea and a similar one on the left corner of the jaw; a knot the size of a hemp seed on the right upper arm. small case.

Light treatment Jul 5 to Sept 3, Oct 19 to

2 Nov 98 (67 séances). 15 Nov 99. Nose and arm free. Two small knots near the left eyebrows and corners of the jaw. A fresh knot on the right cheek.

Light treatment 15 Nov to 16 Dec 99 (24 séances). No symptoms of illness since Dec. 99. Medical control at home. Last letter 25 June 02.

Medical report no. 37

No. 165. WG, age 19, Zealand (city).

Aunt to Tub. pulp. died; Patient scrofulous as a child.

lup. vulgar right cheek for 15 years. Slow growth, previously cauterized twice with local healing.

6 Jul 98. Healthy appearance. The right cheek is affected: a scar 2 x 2 cm, in the edge of which a few knots. small case.

Light treatment July 6 to July 28, 1998 (5 séances). No symptoms of illness since July 98. Last checked 6-May-02. Little visible scar.

No. 170

Medical report no. 38

Shared flat, 26 years, Jylland (Country). no tub in the family; Patient previously had a cervical gland tumor.

lup. vulgar since 10 years, started on the left cheek; fairly rapid growth over cheek and neck. Vigorously treated with lapis, scraping and thermocaustic with temporary success.

23 Jul 98. Healthy appearance. The left cheek is affected in an area of 10x5 cm with numerous nodules covered with scabs, scar tissue in places; a scar on the neck, in which two knots the size of a pea. big case.

Light treatment July 23 to Oct. 22, 1998 (79 séances).

Pyrogall Ointment.

April 30, 1900. Smooth cicatricial tissue in which seven fresh nodules.

Light treatment April 30 to June 13 oo (26 séances). No symptoms of illness since June oo. Medical control at home. Last letter 3 Aug 02.

Medical report no. 39

No. 171

WG, 25 years old, married, Jylland (country). Mother's Parents at Tub. pulp. died, a brother has lupus vulg. (Pt. No. 99); Patient scrofulous as a child.

lup. vulgar since 12 years, started on the tip of the nose, slowly growing over the nose and upper lip. Repeated treatment with scraping, thermocaustic and tuberculin with temporary success.

July 27, 1998. Somewhat anemic with cervical glandular tumor. The skin over the cartilaginous part of the nose and upper lip is affected with redness, scaling and isolated knots. small case. Scattered nodules in the nasal cavity.

Light treatment July 27 to Oct. 26, 1998 (78 séances). On the mucous membranes:

Sublimattamp., Jod-Iodkali.

No symptoms of illness since Oct. 98. Last

Last checked 7 Mar 99. Little visible scar tissue. Letter 28 Sep 02.

Mucosal affection not completely healed.

Medical report no. 40

No. 181. WG, 37 years, married, Jylland (city).

no tub in the family; Patient previously healthy.

lup. vulgar of the nose for 8 years, starting from the nasal cavity. Vigorous treatment with scraping, thermocaustic and caustic ointments with temporary success.

13 Aug 98. Healthy appearance. The tip of the nose is red, shows nodules and a small ulceration.

small case. Affection diffused in the nasal cavity. tear duct affection.

Light treatment 13 Aug to 13 Sept 98 (27 séances). On the mucous membranes:

sublimatamp. No symptoms of illness since Sept. 98. Medical control at home. Last letter 13 May 02.

Mucosal affection healed.

Medical report no. 41

Vo. 182. WG, 23 years, Jylland (city).

no tub in the family; Patient previously healthy.

lup. vulgar left cheek for 7 years, slow growth; not treated before.

15 Aug 98. Healthy appearance. The left cheek is affected: a spot, 2X 1 cm with connected scaly nodules. small case.

Temporarily interrupted light treatment 15 Aug.

to Nov. 16, 98 (29 séances). No symptoms of illness since Nov.98. Last checked on June 17th: Scar only slightly visible. Letter 11 Aug 02

Medical report no. 42

No. 183. WG, 29 years, Fyen (country).

father to tub. pulp. died ; Patient previously healthy.

lup. vulgar for 20 years, starting from the nasal cavity, quite rapid growth over the nose, later over the upper lip and right cheek. Treated vigorously with thermocaustic 10 years ago with temporary success. Not treated later.

16 Aug 98. Healthy appearance. The entire nose is affected (with swelling, redness, ulcerations, nodules and a significant defect), the middle one

Upper lip and right cheek (3 x 5 cm). - Big case.

Dispersed affection in the nasal cavity and on the gums of the upper jaw. Tear canal affection.

Light treatment 16 Aug 98 to 28 Feb 99 (101st

séances).

On the mucous membranes:

Sublimattamp., JodJodkali. No symptoms of illness since Febr. 99. Last checked 23 Jul 02: Smooth beautiful scar tissue. Defect as before treatment.

Mucosal affection healed.

Medical report no. 43

No. 184th MG, 25 years, Jylland (city).

no tub in the family; patient previously healthy.

lup. vulgar since 6 years, starting from the nasal cavity; only a few nodules by heart, which are never treated.

18 Aug 98. Healthy appearance. The nose is red, swollen and shows isolated nodules; isolated knots on the upper lip and left cheek. - Small case. - Extensive affection in the nasal cavity with large perforation in the septum cart.

tear duct affection. Light treatment Aug. 18 to Sept. 23, Oct. 20 to Nov. 4, 1998 (45 séances). On the mucous membranes:

Sublimattemp., Iodine-Iodinepotassium, Galvanocaustic. 18 Jan 99. Two distinct spots on upper lip,

galvano-caustic. No symptoms of illness since Jan. 99. Last checked 28 Sep 02. Little visible scar tissue.

Mucosal affection almost healed.

Medical report no. 44

No. 191

MG, 38 years old, Jylland (city).

no tub in the family; Patient with tub for 4 years.

4 pulp. suffering.

lup. vulgar of the nose for "%. year, not treated.

5 Sep 98. Fairly healthy appearance; Affection of the apex of the left lung. The tip and left wing of the nose are red, show numerous nodules and a minor defect. small case.

light treatment. 5 Sept to 4 Oct 98 (26 séances).

14 Aug oo. A small ulceration and two small nodules on the nostril.

Temporarily interrupted light treatment until 22 Sep

tember oo (17 séances). No symptoms of illness since September oo. Medical control at home. Last letter 20 Oct 02.

Medical report no. 45

No. 200. WG, 37 years old, married, Jylland (city).

no tub in the family; Patient always healthy.

lup. vulgar for 18 years, started on the nose; slow growth beyond the nose and onto both cheeks. Previously treated with ointments and repeated scrapings with temporary success.

26 Sep 98. Healthy appearance. Almost the entire nose is affected, with swelling and numerous nodules; small defect of the nostrils. The affection extends to both cheeks with isolated nodules. - Medium sized case. Scattered nodules in the nasal cavity.

Light treatment 26 Sep to 26 Nov 98 (54 séances). On the mucous membranes:

Sublimattamp., Jod-Iodkali.

No symptoms of illness since Nov. 98. Last checked 13-May-99: Little visible scar; Defect as before the treatment. letter 8 Aug 02

Mucosal affection healed.

Medical report no. 46

No. 204. WG, 19 years, Jylland (country).

Three Brothers at Tub. pulp. died; Patient scrofulous as a child.

lup. vulgar of the nose for 8 years, slow growth. Previously a single scraping with little success. Recent affection under the chin.

10 Oct 98. Healthy appearance. The tip of the nose and part of the nostrils are swollen; a good pea-sized ulceration surrounded by nodules; minor defect of the right nostril. A single pea-sized knot under the chin. small case. narrowed nostrils. Scar in the nasal cavity after the affection has healed.

Light treatment Oct. 10, 98 to Jan. 9, 99 (78 séances. Scit Jan. 99 no symptoms of illness. Medical control in the house. Last letter Dec. 10, 01.

Medical report no. 47

No. 210

Shared flat, 13 years, Jylland (Country). no tub in the family; Female patient scrofulous from the age of 9: cervical gland tumor, eye trouble; a year ago pleurisy.

lup. vulgar since 2 years, started on the right nostril, progressive growth. operation with part. wise removal of the alar of the nose, not treated later.

No information about mucosal diseases.

Oct. 26, 1998. Sickly appearance, cervical gland swelling, infiltration of the apex of the right lung. The skin over the cartilaginous part of the nose is swollen, numerous nodules, defect of the right nostril and destruction of the nasal septum. A few knots on the left cheek. The right half of the upper lip is slightly swollen with small lumps. Medium case. - Large perforation in the cartilage septum in the nasal cavity, ulceration in the right vestibule, isolated nodules on the mucous membranes. Gums seized in the upper jaw. Bilateral tear duct affection.

Light treatment Oct. 26, 98 to Jan. 26, 99 (78 séances). On the mucous membranes:

Sublimattamp., Iodine-Iodinepotassium, Nitr. argent. No symptoms of illness since Jan. 99. Medical control at home

Died June oi of intestinal tuberculosis.

Medical report no. 48. (See Plates XV and XVI.)

No. 212

Shared flat, 29 years, Jylland (Country).

no tub in the family; Patient previously healthy.

lup. vulgar for 13 years, started on the left hand; 6 years ago simultaneously on the face and on the right hand, 1 year ago on the left foot. progressive growth. Repeated treatment with thermocaustic, scraping and ointments with little success.

29 Oct 98. Healthy appearance. Affected are: right cheek, a spot (8 x 3 cm), left cheek (5X3), forehead (2 x 2), under the chin (2 x 2): flat, coherent nodule formation. Extensive nodular affection on both hands and arms, a spot (2 x 2 cm) on the left foot. Very widespread case. Isolated ulcerations in the nasal cavity, mainly on the septum cartilage. Nodules formed on the gums of the mandible, epiglottis swollen, uneven, nodular.

Light treatment (face) 29 Oct 98 to 18 Feb

99 (about 100 séances). On the mucous membranes:

Sublimattamp., Jod-Iodkali. On the extremities:

Pyrogallol., later light treatment. Since Febr. 99: No symptoms of illness on the face. Last checked on June 8th, 2002: hardly visible scars on the face, hands as well; isolated knots on the arms.

Mucosal affection healed.

Medical report no. 49

No. 213th MG, 20 years, Jylland (city).

no tub in the family; Patient previously had a cervical gland tumor and eye problems.

lup. vulgar since 8 years, slowly spreading from the nasal cavity over the nose to the cheeks and upper lip. Treated for a year in the Coastal Hospital, later three hospitalizations with repeated thermocaustic and scrapings, all with temporary success.

1 Nov 98. Healthy appearance. Affected are: almost the entire nose and the part of the cheeks and upper lip closest to it. Scar tissue with numerous nodules, large defect of the soft nose. – Medium-sized case.

The nasal septum is destroyed, the nostrils are severely narrowed, and the mucous membrane is ulcerated.

light treatment 1 Nov. 98 to 16 Mar. 99 (116 séances). On the mucous membranes:

sublimatamp.

No symptoms of illness since March 99. Last June 10 oi checked: Solid scar tissue, defect as before treatment. Letter 22 June 02.

Mucosal affection healed.

Medical report no. 50

No. 218th MG, 34 years, Fyn (land).

Parents and 2 siblings at Tub. died; Patient in his childhood cervical gland tumor.

lup. vulgar for 20 years, spread from the nasal cavity through the nose to the upper lip (further into the mouth) and to the left cheek. Right thumb seized for 12 years. Treatment essentially internal, only a single scraping.

8 Nov 98. Fairly healthy appearance. Affected are: The soft nose, left half of the upper lip, left cheek (9 x 7 cm): significant infiltration, isolated nodules and ulcerations, scarred defect of the nose and upper lip. Ulcerative affection on the right thumb. - Big case. - Nostrils greatly narrowed. The mucous membranes of the upper lip, gums, palate and fauces are affected. Bilateral tear duct affection.

Light treatment 8 Nov. 98 to 3 May 99 (147 séances). On the mucous membranes:

Sublimattemp., Iodine-Iodinepotassium, Galvanocaustic. No symptoms of illness since May 99. Medical control at home. Last letter 9 May 02.

Mucosal affection not completely healed.

Medical report no. 51. (See Plate XVII.)

No. 225

Shared flat, 24 years, Jylland (Country).

no tub in the family; Patient previously healthy.

lup. vulgar since 5 years, beginning on the left nostril, spread quite quickly to the nose and upper lip; treated four times in hospital with scraping and thermocaustic; temporary success.

Nov. 41, 1998. Healthy appearance, minor cervical glandular mass. Affected are: soft nose and left half of the upper lip; hypertrophic, ulcerative affection. Medium case. – Nostrils severely narrowed, isolated nodules on the nasal mucosa. Gums seized in upper and lower mouth.

light treatment 14 Nov. 98 to 15 Mar. 99 (101 séances). On the mucous membranes:

Sublimattemp., Iodine-Iodinepotassium, Galvanocaustic. No symptoms of illness since March 99. Last checked May 29th: Nice scar tissue, minor defect with left nostril collapse. Letter 27 Aug 02

Mucosal affection healed.

Medical report no. 52

No. 228. WG, 39 years, Jylland (country).

Parents at Tub. pulp. died; Patient scrofulous as a child, often coughing.

lup. vulgar since 22 years, starting on the nose, slowly spreading to the left cheek, in later years also to the right cheek and upper lip. Formerly persistent treatment, mainly with scraping, with temporary success.

28 Nov 98: Sickly appearance, Tub. pulp. dext. Left eye affection with loss of vision. In connection with this, the whole nose, upper lip and both cheeks are extensively affected. Affection deeply infiltrated, scarred in places with numerous nodules and ulcerations; significant soft nose defect. — Very widespread case. Nostrils severely narrowed, the affection in the nasal cavity has almost healed.

Light treatment 28 Nov to 28 Apr 99 (129

séances). Pyrogall Ointment. On the mucous membranes:

sublimatamp

27 Oct 99: Smooth scar tissue with a total of 14 distinct nodules.

light treatment 27 Oct to 21 Nov 99 (17 séances). June 23 oo: Only 4 small knots. Temporarily interrupted light treatment until 6 Sept.

1900 (28 séances). No symptoms of illness since Sept. 1900. Medical control at home. Last letter 13 Nov 02.

Mucosal affection healed.

Medical report no. 53

No. 235. M.G,, 23 years, Copenhagen.

father to tub. died; patient previously healthy.

lup. vulgar since 15 years, starting from a suppurating cervical gland, slow growth over the anterior surface of the neck; treated with galvano-caustic for several years; partial improvement.

5 Dec 98: Appears healthy, front surface of neck affected (7 X 9 cm). Scar tissue with numerous larger and smaller nodes. -- Medium sized case.

Light treatment 5 Dec 98 to 4 Feb 99 (52 séances). No symptoms of illness since Febr. 99. Last checked May 21, 1902: Smooth, soft scar tissue.

Medical report no. 54. No. 238th MG, 18 years, Jylland (city).

no tub in the family; patient previously healthy. Messages from Finsen's medical light institute. v, vi 12 lup. vulgar for 10 years, spread from the nasal cavity, rapidly with significant destruction, via the nose, 8 years ago treated in a coastal hospital for 1/2 year, then 1/2 year free. 4 years ago hospitalization with surgical treatment, improvement in places

Dec. 12, 1998. Looks healthy, soft nose affected: scar tissue with significant destruction; along the edge of the nose swelling and redness. small case. - Destroyed the nasal septum; Irregular common nostrils, mucosal affection extensive. The mucous membrane of the upper lip and the gums of the upper jaw are affected. tear duct affection.

Light treatment 12 Dec 98 to 12 Mar 99 (77

séances).

On the mucous membranes:

Sublimattemp., Galvanocaustic. No symptoms of illness since March 99. Medical control at home. Last letter 12 May 02.

Mucosal affection healed.

Medical report no. 55

No. 243. 11th G., 19 years, Copenhagen.

no tub in the family; Patient in his childhood cervical gland tumor, ulcerations in the nose, tear duct affection.

lup. vulgar since 3 years, starting from the nasal cavity; started as a small lump on the right cheek, later rapidly spreading to the nose and upper lip. No previous treatment.

28 Dec 98. Healthy appearance. Affected are nose and upper lip with swelling and isolated lumps;

a stain on the right cheek, approx. 1/2 x 1/2 cm. — Medium-sized case. - Ulcerations covered with scabs in the nasal cavity, large perforation in septum cartilage.

Light treatment 28 Dec 98 to 28 Feb 99 (55

séances).

On the mucous membranes:

Sublimattemp., Galvanocaustic. No symptoms of illness since Febr. 99. Last checked Oct 11, 1900: Little visible scar tissue. letter 8 Aug 02

Mucosal affection healed.

Medical report no. 56. (See Plate XX.)

No. 250. WG, 34 years, married, Falster (city).

no tub in the family, patient always healthy; scabbing in the nose for many years.

lup. vulgar since 4 years, starting from the nasal cavity, quickly spread over the nose and both cheeks; not treated before.

Jan 9, 1999: Appears healthy, minor cervical gland mass; The entire nose and both cheeks are seized symmetrically (approx. 8 x 5 cm). Significant swelling, lumps everywhere, ulcerations on the edges of the nostrils. big case. Isolated ulcerations in the nasal cavity and large perforation in the septum cartilage.

Light treatment 9 Jan to 8 May 99 (101 séances). On the mucous membranes:

Sublimattamp., iodine potash, galvanocaustic. No symptoms of illness since May 99. Last checked on April 17, 1901: scar tissue barely visible, no defect. Letter 30 Dec 01

Medical report no. 57. (See Plate XXI.)

No. 252nd MG, 6 years, Copenhagen.

no tub in the family; Patient pleurisy 3 years ago.

lup. vulgar left cheek for 3 years, slow growth; not treated before.

10-Jan-99. Healthy appearance. In the middle of the left cheek a round spot, about 2 cm, with connected knots. - Small case.

Intermittent light treatment Jan 10

to 1 July 99 (10 séances). No symptoms of illness since July 99. Last checked July 15, 1902: scar barely visible.

Medical report no. 58

No. 254. WG, 29 years, Fyn (town).

no tub in the family; patient formerly healthy; Ulcerations and scabs in the nose for 6 years.

lup. vulgar of the nose for 3/4 year, starting from the nasal cavity. Previously untreated.

13 Jan 99. Appears reasonably healthy. The tip of the nose is swollen, red and shows a pea-sized ulceration. small case. Scattered nodules and ulcerations in the nasal cavity.

Light treatment 13 Jan to 11 Mar 99 (45 séances). On the mucous membranes:

Sublimattamp., Jod-Iodkali. No symptoms of illness since March 99. Last checked on July 20, 1901: scar tissue barely visible, no defect. letter 15 July 02.

Mucosal affection healed.

Medical Report No. 59.

No. 258. MG, 39 years, Fyn (Country).

A sister to Tub. pulp. died; Patient in childhood suppurating cervical glands.

lup. vulgar since 25 years, slowly spreading to both cheeks, nose, right ear and right upper eyelid, starting from the cervical glands. Treated 18 years ago in a coastal hospital, permanent healing of the nose, later numerous scrapings and thermocaustic with little success.

Jan 24, 1999. Appears reasonably healthy. Affected is the lowest part of the right ear, the part of the cheek in front of the ear and further in the form of a belt the neck up to the left corner of the jaw (greatest width 6 cm); on the left cheek a spot, 8X3 cm, on the right upper eyelid a small ulceration with nodules in the area. Affection flat, scarred in places with numerous nodules; smooth scar tissue without knots on the nose. big case. Scar in the nasal cavity after the affection has healed.

Light treatment Jan 24 to Mar 11; April 19th to May 9, 99 (62 séances). No symptoms of illness since May 99. Medical control at home. Died summer 01 diabetes.

on

Medical report no. 60

No. 259th MG, 4 years, Copenhagen.

. tubes in the family; Patient cervical gland tumor, eye trouble and ear discharge.

lup. vulgar left cheek for 1/2 years, previously not treated.

Jan 25, 1999. Fairly healthy appearance, cervical glandular mass. On the right cheek a spot 2x 1 cm; swollen, red, with knots. small case.

Intermittent light treatment Jan 25

to March 23, 99 (8 séances). No symptoms of illness since March 99. Last checked Aug. 30: scar barely visible.

Medical report no. 61. (See Plate XXII.) No. 266. WG, 23 years old, Sweden (country).

Parents and several siblings at Tub. died. Patient in childhood glandular tumor and eye trouble.

lup. vulgar since 7 years, slowly spreading from the left nostril to the soft nose, a little to the upper lip and left cheek; at the same time ulcerations in the nose. Only treated with home remedies. 2 Feb 99.

healthy appearance. The soft nose is completely affected: hypertrophic, ulcerative affection; Scar tissue with a few knots on the upper lip, a few knots on the left cheek. Medium case.

Extensive mucosal affection in the nasal cavity with perforation in the septum cartilage. Bilateral tear duct affection.

Light treatment 2 Feb to 19 May 99 (90 séances). On the mucous membranes:

Sublimattamp., Jod-Iodkali. No symptoms of illness since May 99. Last checked on March 3rd, 2002: little visible scar tissue, no defect.

Mucosal affection healed.

Medical report no. 62

No. 274

Flat share, 10 years, Norway (city).

tubes in the family; Patient previously healthy.

lup. vulgar since 2 years, started (after measles) on nasal septum, spread to upper lip and cheeks. Simultaneous spina ventosa and scrophuloderma on the chest.

18Feb99. Healthy appearance, numerous swollen cervical glands.

The nasal septum is swollen, ulcerated; isolated small knots on upper lip and cheeks. small case.

Single nodules in the nasal cavity.

Light treatment 18 Feb to 11 May 99 (60 séances). On the mucous membranes:

Sublimattamp No symptoms of illness since May 99. Medical control at home. Last letter 28 July 02.

Mucosal affection healed, the other tuberculous affections healed spontaneously.

Medical report no. 63. (See Plate XXIII.)

No. 276th MG, 40 years, Jylland (Land).

no tub in the family; Patient always healthy, tear duct affections for many years.

lup. vulgar the nose for 9 years, starting from the nasal cavity; at the same time scattered affection on the throat. First treated with scraping, after which healed for 3 years, later tuberculin with temporary success.

20-Feb-99. Healthy appearance. The xase is affected with heavy infiltration, nodules and ulcerations covered with scabs. 4 small knot-like spots on the neck. Medium case. Swelling, lumps and ulcerations in the nasal cavity.

Light treatment 20 Feb to 23 Jun 99 (105 séances).

On the mucous membranes:

Sublimattemp., Galvanocaustic. No symptoms of illness since June 99. Last checked Aug. 30: little visible scar tissue, no defect. letter 6 May 02

Mucosal affection almost healed.

Medical report no. 64

No. 283

Shared flat, 8 years, Jylland (Country).

no tub in the family; Patient previously healthy.

lup. vulgar for a year, started on the nose; lately spread to upper lip and left cheek. Treated in hospital with excision without success, later treatment with ointments.

March 7, 1999. Looks healthy, cervical glandular tumor. Affected are: soft nose, which is severely swollen with lumps and ulcerations and a fairly large defect in the left nostril; some knots on upper lip and left cheek. small case. Scattered nodules in the nasal cavity.

Light treatment March 7th to June 26th '99 (30 séances). On the mucous membranes:

sublimatamp. No symptoms of illness since July 99. Checked 24 Feb 00: Little visible scar tissue, defect only small. Last letter 17 Aug 02.

Mucosal affection barely healed completely.

Medical report no. 65

No. 295. Shared flat, 66 years old, married, Sweden (city).

no tub in the family; Patient previously healthy.

lup. vulgar for 15 years, starting from the nasal cavity, was limited to the edges of the nostrils for a long time, has spread to the nose, upper lip and cheeks in recent years. Resistant treatment: scraping, thermo

: caustic and caustic ointments with temporary success.

April 11, 99. Healthy appearance. Affected are: soft nose, quite significant defect and ulceration in the vicinity of the nostrils, also isolated nodules. The upper lip is badly swollen, shows large ulcerations; isolated knots on the cheeks. - Middle

nostrils severely narrowed with ulceration in vestibule; Ulcerated mucosa of upper lip.

Light treatment April 11 to July 29, 1999 (75 séances). On the mucous membranes:

Sublimatamp., nitras argenti. No symptoms of illness since July 99. Medical control at home. Last letter 21 Sep 02.

big case.

Medical report no. 66

No. 303

WG, 59 years, married, Jylland (country). Two Sisters at Tub. pulp. died; Patient previously healthy.

lup. vulgar for 16 years, slowly spreading from the nasal cavity to the nose, in recent years to both cheeks. Previously little treatment.

21 Apr 99. Healthy appearance. The whole nose is affected with swelling, large ulceration, lumps and a small defect. Isolated lumps and ulcerations on both cheeks. Medium case. - Isolated nodules in the nasal cavity, perforation in Sept. cart.

Light treatment April 21 to Oct. 25, 1999 (154 séances). On the mucous membranes:

sublimatamp. No symptoms of illness since Oct. 99. Medical control at home. Last letter 22 Feb 02.

Mucosal affection healed.

Medical report no. 67

No. 308

Flat share, 18 years, Zealand (country). no tub in the family; Patient in childhood supressing cervical glands.

lup. vulgar for 5 years, starting from the nose, lately slowly spreading to the upper lip and both cheeks. Often treated with galvano-caustic with little success.

April 24, 1999. Fairly healthy appearance. The soft nose is affected with redness, isolated nodules and ulcerations; upper lip swollen with isolated knots, 3-4 knots on right cheek, 1 knot on left cheek.

Medium case. - Scattered nodules in the nasal cavity. Gums of the upper jaw, fauces and throat seized.

Light treatment April 24 to Aug. 31, 1999 (73 séances). On the mucous membranes:

Sublimattemp., Iodine-Iodinepotassium, Galvanocaustic. No symptoms of illness since Aug. 99. Last checked Dec 19 oi: Little visible scar tissue. Letter 13 Aug 02

Mucosal affections healed.

Medical report no. 68

No. 309

Shared apartment, 4 years, Copenhagen.

no tub in the family; Patient previously healthy.

lup. vulgar right arm for 4 years; constantly treated with lapis, scraping and galvano-caustic, with partial success.

25 Apr 99. Healthy appearance. On the right forearm a scar, 2X 1 cm, in which a knot the size of a hemp seed. small case.

Light treatment April 25, 99 (1/2 hour).

No symptoms of illness since April 99. Last 6 Sept. oi checked: barely visible scar.

Medical report no. 69

No. 319

Shared flat, 23 years old, Zealand (country).

mother suffers from tuberculosis pulm.; Patient previously healthy.

lup. vulgar right cheek since 8 years; brisk growth in recent months; not treated before.

May 5, 99. Healthy appearance. On the right cheek an irregular spot, 3 x 2 cm, scarred in places, with about 15 superficial nodules the size of hemp seeds. small case.

Light treatment May 5 to June 22, Aug. 21 to

28 Aug 99 (30 séances). No symptoms of illness since Aug. 99. Last checked 1 May 02: Little visible scar tissue.

Medical report no. 70

No. 322

Shared flat, 19 years, Falster (city). no tub in the family; Patient previously scrofulous, cervical gland tumor, eye trouble and ulceration in the nose.

lup. vulgar since 1 year, has slowly grown from the nasal cavity over the nose and upper lip. Skin affection not previously treated.

& May 99: Healthy Appearance. The tip of the nose and the middle of the upper lip are seized with resp. 10--15 and 3 nodules. small case. Extensive affection in the nasal cavity with large perforation in the Sept. cart.

Light treatment May 11 to July 10, 1999 (38 séances). On the mucous membranes:

Sublimattemp., Iodine-Iodinepotassium, Galvanocaustic. No symptoms of illness since July 99. Last checked 30 Jul 02: Barely visible scars.

Mucosal affection healed.

Medical report no. 71

No. 327

Shared flat, 31 years old, married, Jylland (city). no tub in the family; patient formerly healthy; tear duct affection for many years.

lup. vulgar the nose for 2 years, starting from the nasal cavity; formerly treated with lapis and a single scraping with little success.

May 17, 99. Healthy appearance. The tip of the nose and the nasal septum are affected with 10 nodules. - Small case. - Scattered nodules in the nasal cavity. tear duct affection.

Light treatment May 17th to June 30th, Sept. 20th to

20 Oct 99 (56 séances). On the mucous membranes:

Sublimattemp., Galvanocaustic. No symptoms of illness since Oct. 99. Medical control at home. Last letter April 15, 02.

Mucosal affection not completely healed.

No. 331

Medical report no. 72. (See Plate XXV.)

Shared flat, 18 years, Jylland (Country). no tub in the family; Patient scrofulous in childhood: suppurating cervical glands.

lup. vulgar since 4 years, started on left cheek, fairly rapid growth to nose, upper lip and right cheek; previously treated 3 times with scraping and thermocaustic with temporary success; later only home remedies.

May 20, 99. Healthy appearance. In connection, the whole nose and a part of the left cheek about 4 x 5 cm are seized; only a few knots on upper lip and right cheek. Affection hypertrophic ulcerative. Medium case. -- Isolated nodules and ulcerations in the nasal cavity and on the gums of the upper jaw, small perforation in septum cart.

Light treatment 20 May to 15 Oct 99 (125 séances). On the mucous membranes:

Sublimattemp., Galvanocaustic. No symptoms of illness since October 99. Last checked on August 30th: Nice, little visible scar tissue (on the upper lip outside the former affection a small fresh nodule, which disappeared after light treatment [4 séances)]. letter 9 May 02

Mucosal affection seems to have healed.

Medical report no. 73

No. 335

Flat share, 6 years, Zealand (country). no tub in the family; Patient cervical gland tumor and adenoid vegetations.

lup. vulgar the right cheek since 1/2 year; no treatment before.

May 29, 99. Healthy appearance. A roundish spot on the right cheek. approx. 2 cm, scar tissue in the middle, numerous knots on the edge. small case.

Temporarily interrupted light treatment until Oct. 4, 1999 (22 séances).

12 Feb 00. A few spots.

Temporarily interrupted light treatment until Oct. 1, 2000 (21 séances).

No symptoms of illness since Oct. 99. Last checked 1 Oct o2: Little visible scars.

Medical report no. 74

No. 354•

MG, 30 years, Zealand (country).

mother to tub. pulp. died; patient previously healthy.

lup. vulgar for 20 years, from the nasal cavity. walked, started on the nose; slow growth; later affection of both cheeks and left ear. Treated 10 years ago in hospital with scarification and pyrogallic ointment with temporary success; later tuberculin without success, in recent years thermocaustic; make wise healing.

27 Jun 99. Healthy appearance. The soft nose is affected with swelling and numerous knots; a single lump on the left cheek, a few scattered lumps on the right cheek, a few lumps and a minor defect on the edge of the left ear. Medium case. - Scars in the nasal cavity after spontaneously healed affection.

Light treatment June 27th to September 23rd '99 (73 séances). No symptoms of illness since Sept. 99. Medical control at home. Last letter 18 May 02.

Medical report no. 75. (See Plate XXVII.)

No. 361

Shared flat, 27 years, Jylland (Country). In the Tub. family; Patient previously scrofulous: cervical glandular tumor, eye problems.

lup. vulgar 14 years old, started on upper lip, progressive growth despite vigorous treatment; essential with scraping and thermocaustic; repeated hospitalization.

3 Jul 99. Healthy appearance. The entire nose, upper lip and large areas of both cheeks are affected. Significant infiltration, scarred in places with numerous nodules and ulcerations, defect of the soft nose. big case. narrowed nostrils. The mucous membranes of the nasal cavity, upper lip, gums and palate are affected. tear duct affection.

Light treatment July 3 99 to January 26 oo (156

séances).

On the mucous membranes:

Sublimattemp., Iodine-Iodinepotassium, Galvanocaustic.

March 5 oo. Nice scar tissue everywhere, just

, few deep knots.

Mucous membranes healed in places.

Temporarily interrupted light treatment until May 9th

oo (32 séances). No symptoms of illness since May oo. Last checked on Sept. 29th, 2002: Nice scar tissue, nose defect as before the treatment.

Mucosal affections healed.

Medical report no. 76

No. 363

Flat share 32 years, married, Jylland (country). Father and several siblings at Tub. died; Patient scrofulous as a child; repeated pulmonary symptoms.

lup. vulgar of the nose for 14 years, is well contained by vigorous treatment with scraping and caustics.

5 July 99. Appears fairly healthy; Infiltration of both lung apexes. The skin over the cartilaginous part of the nose is swollen, showing lumps and ulcerations, minor defect. -- Small case. Healed affection in the nasal cavity with a large perforation in the septum cart.

Light treatment 5 July to 11 Sept 99 (40 séances). No symptoms of illness since Sept. 99. Last Aug. 31 or checked: Little visible scar tissue. Letter 29 April 02.

Mucosal affection constantly free.

Medical report no. 77

No. 368

Flat share, 16 years, Zealand (country).

no tub in the family; Patient previously healthy.

lup. vulgar right cheek since 4 years; growing lately; not treated earlier. July 11, 99.

healthy appearance. On the right cheek a round lupus spot, about 1 cm, with scaly, confluent nodules. small case.

Temporarily interrupted light treatment until 5 Sept.

99 (23 séances). No symptoms of illness since Sept. 99. Last checked Aug. 9, 2002: Scar barely visible.

Medical report no. 78

No. 370

Shared flat, 31 years, Switzerland (city).

no tub in the family; Patient previously healthy.

lup. vulgar since 19 years, started on the right cheek, lasted for 10 years as a small ulceration, which erupted constantly despite treatment, then spread to the nose and 4 years ago to the cheeks, despite constant and vigorous treatment with galvano-caustic and caustics.

13 Jul 99. Healthy appearance. Affected are the skin over the cartilaginous part of the nose and the part of the cheeks closest to it, symmetrical, approx. 4 x 3 cm: scar tissue everywhere with numer

< rich nodules, small defect of the nostrils; a single pea-sized knot on the upper lip. Middle

big case.

narrowed nostrils. Scars in the nasal cavity after the affection has healed.

Light treatment July 13 to November 11, 1999 (116 séances).

March 15 oo. Nice scar tissue, just a single small lump on the left nostril.

Light treatment in Paris (few séances). No symptoms of illness since spring oo. Last message April 01.

Medical report no. 79

No. 371st MG, age 39, Norway (city).

mother to tub. pulp. died; patient previously healthy.

lup. vulgar of the nose for 20 years, starting from the nasal cavity. Earlier 11/2 year hospitalization: surgical treatment with little success; then treated with caustics. Healing in places with a large loss of substance.

15 Jul 99. Healthy appearance. The nose is affected with a large defect, only a few lumps and ulcerations; scars on the cheeks after the affection has healed. small case. Common irregular nostrils;

extensive mucosal affection in the nasal cavity with total defect of the septum cartilage. Ulcerated gums in the upper jaw.

Light treatment July 15 to Nov 2, '99 (76 séances). On the mucous membranes:

Sublimattemp., Iodine-Iodinepotassium, Galvanocaustic.

July 7 oo. A few scaly nodules in the scar tissue. Nasal cavity improved, gums healed.

Partially interrupted light treatment until 6 Sept

00 (26 séances). On the mucous membranes:

like in old times. Messages from Finsen's medical light institute. v, vi

No symptoms of illness since Sept. oo. Last checked Dec 19 oi: Nothing suspicious on the skin. letter 6 Oct 02

Mucosal affection not completely healed.

Medical report no. 8o.

No. 374

Shared flat, 16 years, Copenhagen.

no tub in the family; Patient previously healthy.

lup. vulgar left cheek for 3 years, lately increased growth; treated with Pyrogallus ointment with little success.

19 Jul 99. Healthy appearance. On the left cheek a rounded spot, about 2 cm, flat, with scaly, confluent nodules. small case.

Light treatment July 19 to Sept. 14, 99 (25 séances). No symptoms of illness since Sept. 99. Last checked Aug. 13, 2002: Scar barely visible.

Medical report no. 81

No. 383

Shared flat, 19 years old, Copenhagen.

no tub in the family; Patient previously healthy.

lup. vulgar left arm for 6 years, slow growth; formerly treated with caustic ointments, in recent years constantly with galvano-caustic; local healing.

31 Jul 99. Healthy appearance. In the left elbow cavity a lupus patch, 3 x 4 cm, scarred in places with numerous flat nodules, especially along the edge. Medium case.

Light treatment July 31 to Sept. 30, 1999 (54 séances). No symptoms of illness since Sept. 99. Last checked 3 Jul 02: Smooth soft scar tissue.

Medical report no. 82

No. 388. WG, 36 years, Copenhagen.

no tub in the family; Patient scrofulous as a child: cervical gland tumor, eye problems.

lup. vulgar since 24 years, starting from the nasal cavity; in the first few years quite strong growth over the nose, upper lip and cheeks. Vigorous treatment with repeated scrapings 16 years ago, with local healing; later permanent lapis bore:

Aug 14, 1999. Appears fairly healthy. The nose is affected with a fairly large defect, scar tissue and isolated nodules, whitish scars on the cheeks and upper lip, in which individual nodules. Medium case. -- Extensive ulceration in the nasal cavity with large perforation in Sept. cart.

Light treatment 14 Aug to 14 Oct 99 (52

séances).

On the mucous membranes:

Sublimattemp., Iodine-Iodinepotassium, Galvanocaustic. No symptoms of illness since Oct. 99. Last checked 16 Apr 02: Smooth pale scar tissue. Defect as before treatment.

Mucosal affection almost healed.

Medical report no. 83

No. 389th MG, 10 years, Jylland (city).

no tub in the family; Patient early affection of the left elbow.

lup. vulgar right cheek for 31/2 years; slow growth; no treatment. Aug 16, 99

healthy appearance. On the right cheek an irregular patch, 3 x 2 cm, with numerous flat nodules and a small ulceration. small case.

Temporarily suspended light treatment until Dec 7th

99 (21 séances). No symptoms of illness since Dec. 99. Medical control at home. Last letter 19 August 02.

Medical report no. 84

No. 394th MG, age 61, Copenhagen.

no tub in the family; patient previously healthy.

lup. vulgar right hand for 1 year (infected at slaughter); fairly rapid growth; treated with boric acid and ointments without success. 21 Aug 99.

healthy appearance. On the right back of the hand an affection of about two marks in size, superficial, infiltrated, with ulcerations, diffuse pigment and a few typical nodules. Medium case.

Light treatment Aug. 21 to Oct. 21, 1999 (52 séances). No symptoms of illness since Oct. 99. Last 8 Nov O2 checked: Barely visible scar.

Medical report no. 85

No. 406. WG, 16 years, Jylland (country).

no tub in the family; patient formerly healthy; in the last 2 years cervical gland tumor and isolated scrophuloderma, which has healed by means of scraping.

lup. vulgar of the nose for 3 years, started as a small ulceration; after thermocaustic temporary healing.

13 Sep 99. Healthy appearance. Nut-sized cervical glands, scars after scrofula. Tip of nose and left nostril swollen, red, with a few small nodules.

small case. Isolated nodules in the left side of the nasal cavity.

Light treatment 13 Sep to 10 Oct 99 (23 séances). On the mucous membranes:

sublimatamp. No symptoms of illness since Oct. 99. Medical control at home. Last letter April 14, 02.

Mucosal affection healed.

Medical report no. 86

No. 407

38 years old, married, Bogó (countryside).

In the family of the mother Tub.; Patient previously healthy.

lup. vulgar the nose for 7 years; slow growth; little treatment.

15 Sep 99. Healthy appearance. The whole soft nose swollen, with fairly large ulcerations covered with scabs and isolated nodules ; small defect of the nostril edges. small case. In the nasal cavity the mucous membrane is scarred after spontaneously healed affection, some scab formation.

Light treatment 15 Sep to 4 Dec 99 (57 séances). On the mucous membranes:

sublimatamp. No symptoms of illness since Dec. 99. Medical control at home. Last letter 1 Oct 02.

No. 411

Medical report no. 87

Shared flat, 16 years, Jylland (Country).

no tub in the family; Patient previously healthy.

lup. vulgar the nose since 3/4 year; treated with indifferent ointment.

22 Sept 99. Thin and pale appearance. The underside of the nose red, swollen, with an ulceration of 1 cm; a few nodules on the upper lip. — Small case. - Isolated nodules in the nasal cavity. Soft palate, uvula and anterior arches swollen with small ulcerations. Temporarily interrupted light treatment 22 Sept.

to 15 Dec 99 (54 séances). On the mucous membranes:

Sublimattemp., Iodine-Iodinepotassium, Galvanocaustic.

August 9 oo. A small knot on the right nostril. nasal cavity free; Palate and throat healed in places.

Light treatment 9 Aug to 31 Aug 00 (10 séances). On the mucous membranes:

Potassium iodine, galvanic caustic. No symptoms of illness since August oo. Last checked 29 Oct 02: Little visible scar tissue.

Mucosal affection persistent under treatment. May 8 or: Fresh lupus of the larynx, later almost healed.

No. 412

Medical report no. 88

MG, 18 years old, Jylland (city).
mother to tub. pulp. died; patient previously healthy.

lup. vulgar since 4 years, started on both cheeks at the same time, has been limited for a long time, in the last 2 years the growth has extended to the cheeks, nose and left upper eyelid; treated with scarifications in recent years, which prevented growth.

26 Sep 99. Healthy appearance. Scattered nodules of the soft nose; slight infiltration in the middle part of both cheeks, numerous scaly nodules from the size of a grain of millet to two pennies. A pea-sized lump on the upper left eyelid. Medium case.

light treatment 26 Sept 99 to 20 Jan oo (92 séances). on the cheeks;

Pyrogall Ointment.

May 26, 00. Smooth scar tissue; individual diffusely pigmented areas.

Light treatment May 26 to July 23 oo (50 séances). No symptoms of illness since July oo. Patient traveled to America. Last letter 27 July 02.

Medical report no. 89

No. 413

WG, 53 years, married, Jylland (country). no tub in the family; Patient scrofulous as a child: suppurating cervical glandular tumors.

lup. vulgar the nose for 6 years, starting from the nasal cavity; slow growth; once treated with thermocaustic with little success.

27 Sep 99. Healthy appearance. Soft nose swollen, spongy, with confluent nodules ulcerated in places. small case. Affection diffused in the nasal cavity.

light treatment Sept. 27, 99 to March 8, oo (128 séances). On the mucous membranes:

Sublimattamp., Jod-Iodkali. No symptoms of illness since March. Last Aug 30

Controlled: Little visible scar tissue. (On the right jaw angle a barely healed scrophuloderma. Light treatment 2 séances). letter 4 May 02

Mucosal affection healed.

O I

Medical report no. 90

No. 414

W'. G., 10 years, Jylland (town).

Father and several siblings Tub.; Pat. formerly healthy.

lup. vulgar since 5 years, started on the nose, repeated treatment with scraping, lapis etching, mercury ointment; temporary improvement with increasing loss of substance. 28 Sept 99

healthy appearance. The skin over the cartilaginous part of the nose shows swelling, defect, redness and numerous nodules. In the area, on both cheeks and upper lip, single nodules. -- Small case.

In the nasal cavity the affection is spontaneous with perforation in Sept. cart. healed.

Temporarily interrupted light treatment 28 Sept.

to Dec. 12, 1999 (32 séances). 14 Aug oo. Smooth, soft scar tissue, same defect as before treatment. A fresh knot the size of a pea on the upper lip.

Light treatment until Aug. 28 oo (u séances). No symptoms of illness since Aug. 00. Medical control at home. Last letter 3 July 02.

Mucous membrane constantly free.

Medical report no. 91

No. 435

MG, 60 years, Jylland (city). no tub in the family; Patient with early tuberculosis of the lower extremities.

lup. vulgar since 35 years, starting from the nasal cavity; slow growth over nose, upper lip and cheeks; often treated with scratching, lapis etching, etc.; partial improvement.

6 Nov 99. Healthy appearance. Affected are the nose, upper lip and both cheeks to a large extent. Affection cicatricial with significant defect of soft nose; only isolated, scaly, superficial nodules. Medium case. - Scars in the nasal cavity after spontaneously healed affection.

Light treatment 6 Nov to 29 Dec 99 (29 séances). No symptoms of illness since Dec. 99. Medical control at home. Last letter 9 Dec on.

Medical report no. 92

No. 436th MG, 23 years, Fyen (land).

father to tub. pulp. died; patient previously healthy.

lup. vulgar the nose for 4 years; slow growth; Resistantly treated with lapis etching with local annealing.

7 Nov 99. Healthy appearance. Scar tissue on the tip of the nose, in which nodules. small case. Scattered nodules in the nasal cavity.

Temporarily interrupted light treatment 7 Nov.

99 to May 5 oo (56 séances). On the mucous membranes:

Sublimattemp., Iodine-Iodinepotassium, Galvanocaustic.

May 5 oo. Febrile rheumatica. June 7 oo. hemoptysis. 1 Oct. oo. smooth scar tissue; a dubious pigment spot on the right nostril; nasal cavity free; General health good.

Light treatment 1 Oct 00 (2 séances). No symptoms of illness since Oct. oo. Last checked 28 Dec 02: Little visible scar tissue.

Mucosal affection healed.

Medical report no. 93

No. 437th MG, 18 years, Jylland (Land).

no tub in the family; patient previously healthy.

lup. vulgar left ear for 5 years; progressive growth despite constant treatment with caustic ointments.

7 Nov 99. Healthy appearance. The left ear is affected in toto with numerous nodules, some of which are covered with scabs; quite large defect of the helix rim.

Medium case.

Light treatment 7 Nov to 7 Dec 99 (26 séances).

March 10 oo. Nice scar tissue; nodules evident only on lobule.

Light treatment March 10 to May 28 oo (55 séances). No symptoms of illness since May oo. Last checked on Dec. 28: smooth scar tissue, defect as before treatment. letter 1 July 02.

Medical report no. 94

No. 439.

Shared flat, 16 years, Jylland (Country). no tub in the family; Patient previously scrofulous: bone affection with scrophuloderma.

lup. vulgar the forehead since the age of 21; slow growth; little treatment.

9 Nov 99. Healthy appearance. Isolated scars after the above affections. In the middle of the forehead a roundish lupus spot, about 2 cm, with confluent scaly, prominent nodules. small case.

Intermittent light treatment 9 Nov 99

to March 7 oo (28 séances). Pyrogall Ointment

(once in 4 days). No symptoms of illness since March oo. Medical control at home. Last letter 15 July 02.

Medical report no. 95

(Plate XXXII.)

No. 443rd MG, 21 years, Jylland (Land).

A cousin suffers from lup. vulgar (Pat. No. 210); Patient formerly dorsal spondylitis.

lup. vulgar since 9 years, started on the nose; fairly rapid spread to upper lip and cheeks. Once scratched out with temporary improvement, later treated with iodoform, which seems to have stopped the spread.

2 cm.

Nov. 21, 1999. Fairly healthy appearance; kyphosis. Affected are almost the entire nose, upper lip, large parts of the cheeks (7 x 7 cm on each): confluent, prominent, scaly nodules, isolated scar tissue, defect in both nostrils. A roundish lupus spot from Grosser Fall on the right temple. In the nasal cavity the affection is spontaneous with perforation in septum cart. healed.

light treatment Nov. 21, 99 to July 21, oo (204 séances). No symptoms of illness since July oo. Checked Aug. 30 or: Smooth, little visible scar tissue, nasal defect as before treatment. Last letter 15 July 02.

Mucous membranes constantly free.

No. 445.

Medical report no. 96. (See Plate XXXIII.)

Shared flat, 17 years, Jylland (city).

no tub in the family; Patient previously healthy.

lup. vulgar right cheek since 2 years; started following scrophuloderma; treated with lapis etching with temporary success.

22 Nov 99. Healthy appearance. On the right cheek close to the ear 2 irregular scars, in which 5--6 small knots. - Small case.

Temporarily interrupted light treatment 22 Nov.

99 to March 16 oo (33 séances). No symptoms of illness since March oo. Checked Aug. 30 or: Smooth, barely visible scar. Last letter 13 July 02.

Medical report no. 97

No. 447

Shared flat, 40 years, Fyen (countryside). Father and several relatives at Tub. pulp. died; Patient previously healthy.

lup. vulgar of the nose for 20 years, originating from the nasal cavity; durable treated with thermocaustic; temporary healing with increasing loss of substance.

25 Nov 99. Healthy appearance. Affected is the soft nose with a significant defect, almost complete closure of the nostrils, scar tissue with a few scaly nodules. - Small case. nasal cavity cannot be missed; Perforation in Sept. cart.

Intermittent light treatment Nov 25

99 to April 21 oo (65 séances). No symptoms of illness since April oo. Last checked Aug. 9, 02: Smooth scar tissue (plastic surgery was done with little result).

Mucosal affection apparently healed.

Medical report no. 98. (Plate XXXIV.)

Vo. 449.

Shared flat, 22 years, Jylland (Country).

no tub in the family; Patient previously healthy.

lup. vulgar since 6 years; started on the left nostril, at about the same time on the right arm, later spots on the forehead and right cheek; slow growth; treated with scraping and lapis etching with little success.

27 Nov 99. Healthy appearance. disseminated affection; on the tip of the nose and the left nostril a patch of 2 x 3 cm, with merging knots; also on the bridge of the nose, forehead and right cheek together 7 to pea-sized, flat, nodular spots; on right upper arm a similar spot, 1 X 1'/, cm. -- Medium sized case.

Light treatment 27 Nov 99 to 10 Mar oo G7

séances).

I

No symptoms of illness since March oo. Checked Aug 30, 01: Smooth, barely visible scars. Last letter 16 Jun 02.

Medical report no. 99

No. 453rd MG, 10 years, Jylland (Land).

no tub in the family; patient healthy.

lup. vulgar left cheek for 2 years; slow growth; little treatment.

Nov. 28, 1999. Appearance healthy. A rounded scar, 1 cm in diameter, with flat nodules, centered on left cheek. small case.

Light treatment 28 Nov to 15 Dec 99 (9 séances). No symptoms of illness since Dec. 99. Medical control at home. Last letter 20 July 02.

Medical report no. 100

1 Dec 99

No. 454th MG, 18 years, Gläno (Land).

no tub in the family; patient always healthy.

lup. vulgar of the neck for 12 years; slow growth; treated with caustic ointment a few times, healing in places

Healthy Appearance: On the front of the neck, a superficial affection, 6 x 3 cm, scarred in places with numerous flat, scaly nodules. Medium case.

Intermittent light treatment Dec 1, 99 to

5 Feb 00 (38 séances). No symptoms of illness since Feb. 00. Last checked May 25 oi. Smooth, barely visible scar. Letter 28 April 02.

Medical report no. 101

No. 459

WG, 28 years old, married, Jylland (country). Several siblings at Tub. died; Patient in her tenth year with some suppurating cervical glands, otherwise healthy earlier.

lup. vulgar of the nose for 7 years, starting from the nasal cavity. Long healing after scraping; lately growth again despite repeated treatment.

8 Dec 99: Looks healthy. Numerous scars on the neck. The skin over the cartilaginous part of the nose is swollen, reddened, shows distinct nodules and a fairly large ulceration. Defect, especially of the 1st alar.

small case. Nostrils somewhat narrowed, isolated nodules on the mucous membrane.

Light treatment Dec 8, 99 to March 19, 00 (55 séances). On the mucous membranes:

sublimatamp

July 28 oo. Nice scar tissue, desquamation and a few deep nodules on left nostril only. Vase cavity apparently free.

Light treatment July 28th to Aug. 8th (8 séances). Since train. oo no symptoms of illness. Medical control at home. Last letter 17 July 02.

Medical report no. 102

No. 461.

Shared flat, 29 years old, married, Copenhagen.

no tub in the family; Patient previously healthy.

lup. vulgar the nose for 2 years, starting from the nasal cavity; treated with repeated scraping and thermocaustic temporary improvement:

11 Dec 99. Healthy appearance. The soft nose swollen with isolated knots and a pea-sized one

ulceration; Defect of the right nostril. -- Small case. —

; Affection quite widespread in the nasal cavity with perforation in Sept. cart.

Temporarily interrupted light treatment Dec 11

99 to April 27 oo (61 séances). On the mucous membranes:

Sublimattemp., Iodine-Iodinepotassium, Galvanocaustic. No symptoms of illness since April oo. Last checked 11 Jun 02: Smooth, soft scar tissue; Defect as before treatment.

Mucosal affection not completely healed.

Medical report no. 103

No. 475

Shared flat, 24 years, Móen (countryside).

In the next family Tub., patient formerly healthy.

lup. vulgar since 8 years, starting from the nasal cavity, vigorously treated with thermocaustic, scraping, excision and transplantation; local healing; constant new outbreak. Upper lip only recently seized.

1 Feb oo. healthy appearance. Left part of the soft nose solidly scarred, with severe narrowing of the nostril; a fairly large ulceration on the edge of the right nostril, which extends from the nasal septum to the upper lip. small case. The ulceration extends far into the nasal cavity; small perforation in Sept. cart.

Light treatment February 1st to April 3rd 0o (39 séances). On the mucous membranes:

Sublimattamp., Jod-Iodkali. No symptoms of illness since April oo. Patient traveled to America. Last letter 18 Oct 02.

Mucosal affection apparently healed.

Medical report no. 104. (See Plate XXXVII.) No. 485th MG, 6 years, Copenhagen.

no tub in the family; patient quite healthy.

lup. vulgar left cheek for 1/2 years, slow growth, little treatment. 15 Feb 00

Healthy appearance, some nut-sized cervical glands. On the center of the left cheek a rounded lupus patch, barely 2 cm, formed of scaly, prominent nodules. small case.

Intermittent light treatment Feb 15

to April 17 oo (11 séances). No symptoms of illness since April oo. Last checked April 8, 2002: Barely visible scar.

Medical report no. 105

I

No. 495. WG, 26 years old, married, Russia (city).

no tub in the family; Patient previously healthy.

lup. vulgar nose for 6 years, twice healed by long-term thermocaustic treatment; Recurrence after and 2 years. The same treatment for the last 3/4 years without success.

10 Mar 00. Healthy appearance. Soft nose swollen, with numerous nodules, ulceration of the entire left nostril with defect. small case. A few isolated nodules in the nasal cavity.

Intermittent light treatment March 10th

to July 20 oo (63 séances). On the mucous membranes:

iodine-potassium iodine. No symptoms of illness since July oo. Medical treatment at home. Last letter 27 July 02.

Mucosal affection healed.

Medical report no. 106

Vo. 508. WG, 21 years, Fyen (country).

mother to tub. pulp. died; Patient scrofulous: cervical gland tumor and ear problems.

lup. vulgar the nose for 2 years, starting from the nasal cavity; never treated. April 6 oo.

healthy appearance. Soft nose swollen, red with numerous nodules, most of them on the nostrils.

small case. In the nasal cavity isolated affections with small perforation in Sept. cart.

Intermittent light treatment April 6th

to Sept. 8 oo (60 séances). On the mucous membranes:

Sublimattemp., Iodine-Iodinepotassium, Galvanocaustic. No symptoms of illness since Sept. oo. Last ok. Dec 00 checked: Smooth soft scar tissue. Letter 14 Aug 02

Mucosal affection not completely healed.

Medical report no. 107

No. 509

IV. G., 10 years, Copenhagen.

mother to tub. pulp. died; patient healthy.

lup. vulgar for about 10 years, treated with scraping soon after outbreak; has remained roughly unchanged without treatment since that time.

April 7 oo. healthy appearance. An irregular spot in the middle of the left cheek, scarred with five nodules. small case.

Intermittent light treatment April 7th

to May 8 oo (12 séances). No symptoms of illness since May oo. Last checked 1 Nov 02. Smooth, slightly reddish scar tissue.

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Medical report no. 108

No. 511. WG, age 18, Sweden (country).

lup. vulgar the nose for 21/2 years; quite strong growth; left cheek recently seized. Repeated treatment with thermocaustic and pure lactic acid; little success.

April 9 oo. healthy appearance. Whole soft vase much swollen, red with confluent scaly nodules; a pea-sized knot on her left cheek.

small case. - Scattered nodules in the nasal cavity.

Light treatment April 9 to July 20 oo (65 séances. On the mucous membranes:

iodine-potassium iodine. No symptoms of illness since July oo. Last checked on Aug. 30: Nice, little visible varicose tissue. letter 6 Nov 02

Mucosal affection healed.

Medical report no. 109

No. 512

WG, 40 years, married, Jylland (country). father to tub. pulp. died; Patient scrofulous as a child: Ilals glandular tumor, scrophuloderma.

lup. vulgar the nose for 10 years; slow growth; repeated scraping and thermocaustic with temporary success:

April 9 oo. Healthy appearance, isolated solid scars after the affections mentioned. Soft nose swollen, red with confluent nodules ulcerated in places ; minor defect. - Small case. - In the nasal cavity quite extensive affection with small perforation in Sept. cart.

Temporarily interrupted light treatment y. April to

19 Sept. oo (76 séances).

On the mucous membranes:

Sublimattamp., Jod-Iodkali

. No symptoms of illness since Sept. oo. Last checked on July 28, 2002: little visible scar tissue, defect barely visible.

Mucosal affection healed.

Vo. 524

Medical report no. 110

Shared flat, 24 years, Germany (city).

no tub in the family; Patient previously healthy.

lup. vulgar the nose for 2 1/2 years; slow growth; constant treatment with galvano-caustic and X-rays, without success.

May 1st oo. healthy appearance. The tip of the nose and the nasal septum are slightly swollen, red with about 10 small lumps. small case.

Temporarily interrupted light treatment May 1st to

7 July, 4 Sept to 18 Sept oo (41 séances). Scit Sept. oo no symptoms of illness. Medical control at home. Last letter 1 Dec 02.

No. 536.

Medical report no. 111

WG, 27 years old, married, Jylland (country). Relatives on the mother's side Tub.; Patient previously healthy.

lup. vulgar for 20 years, started as a small spot on each cheek, one healed spontaneously, the other has remained unchanged. 2 years ago a new spot on the right cheek, 6 months ago a small spot on the right arm. Skin affection not treated. Affection of the nasal cavity for about 7 years, treated with repeated scraping and galvano-caustic.

June 6 oo. healthy appearance. Isolated affection. A spot on the right cheek, 4 x 3 cm, a roundish spot on the left cheek, approx. 2 cm, a spot the size of a pea on the right arm. Spots formed from prominent, scaly nodules. Medium case. Extensive affection in the nasal cavity with large perforation in Sept. cart. tear duct affection.

Intermittent light treatment June 6 to

8 Aug oo (40 séances). On the mucous membranes:

Sublimattemp., Iodine-Iodinepotassium, Galvanocaustic. No symptoms of illness since Aug. oo. Checked March 11 or: Smooth, soft scars. Few nodules in the nasal cavity. Last letter 22 July 02.

Mucosal affection almost healed.

Medical report no. 112

No. 537. 11th G., 16 years, Jylland (Land).

no tub in the family; patient previously healthy.

lup. vulgar the nose since 1 year, starting from the nasal cavity; not treated earlier.

June 7 oo. healthy appearance. Soft nose, somewhat swollen, isolated ulcerations and lumps on the edges of the nostrils. small case. Few nodules in the nasal cavity.

Light treatment June 7th to June 30th oo (18 séances). On the mucous membranes:

Sublimattamp., Jod-Iodkali. No symptoms of illness since June oo. Checked 24-Oct-00: Smooth, soft x-colored tissue. nasal cavity free. Last letter 1 May 02.

Medical report no. 113

No. 538. 11th G., 18 years, Sjælland (Land).

Two siblings tuberculous: patient scrofulous as a child: cervical gland tumor, eye problems.

lup. vulgar the nose for years; slow growth; not treated before.

June 7 oo. healthy appearance. The right half of the soft nose red, swollen, with isolated scaly nodules. small case. Scattered nodules and ulcerations in the nasal cavity; on epiglottis scars after spontaneously healed affection.

Light treatment June 7th to Aug. 30th 2000 (64 séances). On the mucous membranes:

Sublimattemp., Iodine-Iodinepotassium, Galvanocaustic. No symptoms of illness since Aug.00. Last checked Nov 1st 02: Hardly visible scar tissue.

Mucosal affection healed.

No. 553.

Medical report no.

114

Shared apartment, 4 years, Zealand (country).

Mother suffers from Tub. pulm.; patient healthy.

lup. vulgar of the nose for 5 months, not treated earlier.

June 27 oo. healthy appearance. A small loss of substance in the edge of the left nostril, in its vicinity scar tissue with a few small, flat nodules. small case.

Light treatment June 27 oo (1 séance). No symptoms of illness since June oo. Last checked on Aug. 6, 2002: hardly visible scar tissue, defect as before the treatment.

No. 554

Medical report no. 115

WG, 45 years, married, Jylland (country). Father and a brother at Tub. pulp. died; Patient always sick.

lup. vulgar for 21 years, started on right cheek, soon spread to nose; slow growth; repeated treatment with scraping; local healing

June 27 oo. Lean and anemic appearance. Isolated white scars on the nose and right cheek, only a small ulceration and isolated nodules on the nose. small case. The nasal mucosa affected in places with a large perforation in Sept. cart. tear duct affection.

Intermittent light treatment June 27th

to Sept. 8 oo (45 séances). On the mucous membranes:

Sublimattemp., Iodine-Iodinepotassium, Galvanocaustic. No symptoms of illness since Sept. 00.

Medical control at home. Last letter 17 Oct 02.

Mucosal affection apparently healed.

Medical report no. 116

No. 556. WG, 11 years, Sonderjylland (Land).

no tub in the family; Patient previously healthy.

lup. vulgar left cheek for 3 years; slow growth; not treated before.

July 3 oo. Fairly healthy appearance. In the middle of the left cheek a roundish spot, about 1/2 cm, with merging, scaly knots. - Small case.

Temporarily interrupted light treatment July 3 to

1 Oct 00 (20 séances). No symptoms of illness since Oct. oo. Medical treatment at home. Last letter 19 Oct 02.

Medical report no. 117

No. 558.

II. G., 41 years old, married, Jylland (Country). no tub in the family; Patient always healthy.

lup. vulgar the nose for 1 year, starting from the nasal cavity; formerly a single scraping with little success

July 6 oo. Fairly healthy appearance. Cicatricial formation with numerous nodules on the tip of the nose and along the edges of the nostrils; little loss of substance. - Small case. Scars in the nasal cavity after the affection has healed.

Light treatment July 6th to September 8th oo (48 séances). No symptoms of illness since Sept. oo. Checked 26-May-02:

Little visible scar tissue, defect barely visible. Last letter 16 Oct 02.

Mucosal affection keeps healed.

Medical report no. 118

approx.

No. 562. WG, age 23, Sweden (city).

A brother to Tub. pulp. died; Patient scrofulous as a child: cervical gland tumor, eye problems.

lup. vulgar since 1 year, starting from the nasal cavity. Skin affection not treated earlier.

July 13 oo. Fairly healthy appearance. The soft nose red, swollen with numerous nodules, partly covered with scabs, and a rounded ulceration of

small case. Dispersed affection in the nasal cavity with large perforation in Sept. cart. tear duct affection.

Light treatment July 13 to Sept. 18 00 (40 séances). On the mucous membranes:

Sublimattemp., Iodine-Iodinepotassium, Galvanocaustic.

No symptoms of illness since Sept. oo. controlled 9

Sept. 01: Barely visible scar. Last letter 30 Sep 02.

or

Mucosal affections apparently healed.

I cm.

Medical report no. 119

No. 574th MG, 25 years, Jylland (Land).

A sister suffers from lupus (No. 156.); Patient ailing, with a tendency to cough.

lup. vulgar of the nose for 10 years, slow growth; treated with caustic ointments with temporary success.

8 Aug oo. Slightly pale, with cervical gland swelling: dullness and rales over the tips of the lungs. The soft nose strongly red, swollen; scattered scar tissue with small flat nodules. small case. Affection quite widespread in the nasal cavity; localized cicatricial affection of the soft palate, uvula, palatine arch, and epiglottis.

Light treatment 8 Aug to 28 Sep 00 (46 séances). On the mucous membranes:

Sublimattemp., Iodine-Iodinepotassium, Galvanocaustic. No symptoms of illness since Sept. oo. Medical check-up at home, last letter Oct. 1, 2002.

Mucosal affection not completely healed. General health good.

No. 582.

Medical report no. 120

IV. G., 11 years, Sjælland (Land).

no tub in the family; Patient previously healthy.

lup. vulgar since 1. years right nostril and the nearest part of the cheek; quite rapid growth, which stopped after a scraping. 1 Sep 00. Healthy appearance. On right nose

oo wing scar tissue with little loss of substance and 3 to + scaly nodes; close to these on the right cheek a roundish spot, about 1'. cm, with merging, scaly nodules. small case. Small ulcerations in the right vestibule, otherwise the nasal cavity is free.

Light treatment 1 Sep to 29 Sep 00 (1 2 séances).

To the nasal cavity:

Sublimattamp., Jod-Iodkali. No symptoms of illness since Sept. oo. Last checked Oct 16, 2002: Barely visible scar.

Mucosal affection healed.

Medical report no. 121

No. 587 WG, 5 years, Copenhagen.

In the family of the mother Tub., patient healthy.

lup. vulgar left cheek for 3 years, slow growth; previously treated with caustic ointments. Local healing

15 Sept. oo. healthy appearance. On the middle of the left cheek a rounded scar, about 2 cm, in which 7 to

, 8 scaly nodules. - Small case.

Light treatment 15 Sept and 24 Sept 00 (2 séances). No symptoms of illness since Sept. oo. Last checked 22 Oct 02: Barely visible marbe.

Medical report no. 122

No. 596

Flat share, 7 years, Copenhagen. In the family of the mother Tub.; a brother suffers from lupus (No. 488); Patient previously healthy.

lup. vulgar right arm since 1 year, slow growth; not treated earlier.

27 Sept. oo. healthy appearance. A rounded spot on the right elbow, a good 1 cm, scaly with a few nodules.

small case. Light treatment 27 Sep 00 (2 séances). No symptoms of illness since Sept. oo. Checked Dec 23 or: Barely visible scar. Last letter 20 Aug 02.

Medical report no. 123

No. 60th apartment, 23 years, Fyen (city).

no tub in the family; Patient formerly healthy,

lup. vulgar since 7 years, started on the nose; fairly rapid growth over the cheeks despite repeated scrapings. A little later affection of the right hand.

18 Oct 97. Lean and anemic. The entire soft nose and large parts of both cheeks are affected: numerous protruding nodules covered with scabs, defect in the right nostril. Nodules on the upper right eyelid, the right eye is affected and almost totally destroyed. On the right hand, the affection extends over the back of the hand and onto the fingers, as well as scars after caries. big case. Standing flabby nodules and ulcerations distributed in the nasal cavity.

Light treatment 18 Oct 97 b. 16 Jan 99 (364 séances).

On the hand at the same time: Pyrogallus ointment.

On the mucous membranes:

iodine-potassium iodine.

May 31, 1999. Nice scar tissue all over except 3 dubious nodules on right hand. Still ulcerations in the nasal cavity.

Light treatment May 31 to July 20, 1999 (19 séances).

July 5 oo. Some fresh nodules on the nose, starting from the nasal cavity.

Light treatment July 5th to September 5th 00 (53 séances).

April 20 on. A single knot on the nose, cheeks and hand constantly exposed.

Light treatment April 20 to April 27, July 1 to

July 13 oi (13 seas). No symptoms of illness since July or. Died 9 Jun 02 of acute pulmonary tuberculosis.

No. 97

Medical report no. 124. (See Plate V.)

Shared flat, 28 years, Jylland (Country). A sister suffers from lupus (patient No. 138); Early carpal tuberculosis patient.

lup. vulgar since 17 years, started under the chin, from there progressive growth over left cheek, nose and right cheek. 13 years 1 1/2 year treated in Coastal Hospital; later thermocaustic from time to time, all with temporary success.

5 Feb 98. Healthy appearance. Affected are soft nose, most of both cheeks and chin. Nose swollen with connected nodules covered with scabs, otherwise scar tissue with numerous nodules. big case. -- Well developed affection in the nasal cavity.

light treatment 5 Feb 98 to 20 Jan 99 (245 séances). On the mucous membranes:

Sublimattamp., Jod-Iodkali. galvano-caustic. 26 Jun 99.

Smooth soft scar tissue everywhere, just a few lumps on the nose.

Temporarily interrupted light treatment until 20 Aug.

99 (18 séances). On the mucous membranes:

as before Since August. 99 no symptoms of illness. Died Feb 17 vo after surgery for sinus thrombosis.

Medical report no. 125. (See Plate XII). No. 149th MG, 14 years, Copenhagen.

no tub in the family; Patient previously suppurating cervical glands.

lup. vulgar since 7 years, started on the neck; progressive growth over both cheeks, nose and upper lip. Previously homeopathic treatment only.

June 20, 1998. Weak appearance, cervical glandular tumor. Affected are the whole soft nose, upper lip and the parts of both cheeks closest to it: significant swelling and nodules covered with scabs; on the front of the neck an affection of 4 X12 cm, scarred in places with numerous nodules.

Very widespread case. Extensive affection of the mucous membranes of the nasal cavity, lips, gums, palate, fauces, throat.

Light treatment June 20, 98 to March 8, 99 (176 séances). On the neck at the same time: Pyro

gall ointment. On the mucous membranes:

Sublimattamp., Jod-Iodkali. galvano-caustic.

6 Nov 99. Nice scar tissue all over, just a few lumps. Mucosal affections almost healed.

Light treatment 6 Nov 99 to 6 Jan 00 (50 séances). No symptoms of illness since Jan.oo. Died May 9 oi of chronic empyema.

No. 152.

Medical report no. 126. (See Plate XIV.)

WG, 24 years, Jiro (countryside). no tub in the family; Patient earlier suppurating cervical glands and spina ventosa, later coughing.

lup. vulgar both upper extremities for 20 years: 5 years ago the nose was seized, then both cheeks and left ear. No treatment before.

June 22, 1998. Lean and pale, with affection of apex of left lung. The soft nose and quite large parts of both cheeks are affected in connection: coherent, superficial knots. Left ear: contiguous nodules on lobule. Extensive scarring with fairly numerous nodules on both upper extremities. Very widespread case. Few flabby nodules in the nasal cavity.

Light treatment June 22, 98 to March 21, 99 (240

séances). On the extremities: pyrogallol. On the mucous membranes:

sublimatamp

5 Sept 99. Scarring all over with isolated lumps. General condition quite bad. nasal cavity free.

Temporarily interrupted light treatment Sept. 5, 99 to Sept. 25, oo (168 séances).

No symptoms of illness since Sept. oo, died March 13 or an Tub. pulp.

Medical report no. 127

No. 161. 1st G., 60 years, Sjælland (Land).

Two children tuberculous; Patient healthy in childhood.

lup. vulgar for 45 years, remained for a long time as a stain on the right cheek, spread about 20 years ago

. across both cheeks and nose; treated with scrapings and caustic ointments; little success.

July 2, 1998. Appears fairly healthy, chronic pulmonary affection. Affected are soft nose and large parts of the cheeks: infiltration, scar tissue with numerous disseminated nodules. big case. Scar in the nasal cavity after the affection has healed.

Light treatment July 2nd to Sept. 30th '98 (81 séances). Simultaneously :

Pyrogall Ointment. No symptoms of illness since Sept. 98. Died 15 Mar 99 of Tub. pulp.

Medical report no. 128

Shared flat, 36 years, Jylland (Country). Two siblings at Tub. pulp. died; Patient 10 years ago with pleurisy, was healthy by the way.

No. 173

lup. vulgar for 10 years, started on the nose; long. same growth; no treatment.

Aug. 6, 98. Slightly thin and pale; no pulmonary affection. Whole soft nose is swollen, red with confluent scaly nodules. On the upper lip 1 and on the right cheek 5 to 6 nodules. Medium case. - Few flabby nodules in the nasal cavity.

Light treatment Aug 6 to Nov 5 '98 (77 séances). On the mucous membranes:

sublimatamp.

July 22, 1999. Scattered lumps on nose.

Light treatment July 22 to Aug. 26, 1999 (40 séances).

July 13 oo. Nice scar tissue with a few nodules in it. nasal cavity free.

Temporarily interrupted light treatment until 27 Nov.

00 (15 séances). No symptoms of illness since November 2000. Died Dec 9 or suddenly.

Medical report no. 129

No. 175. 11. G., 44 years, Fyen (land).

no tub in the family; Patient for 5 years tear duct affection, in recent years coughing.

lup. vulg for 3 1/2 years, started on the nose; fairly rapid growth over nose, upper lip and both cheeks; not treated.

Aug. 9, 1998. Fairly healthy appearance; tubes pulp. Affected are the whole nose, large areas of the upper lip and both cheeks: fairly superficial, knotty affection, only on the nostrils ulceration with minor defect. - Big case. - Extensive ulceration in the nasal cavity with perforation in Sept. cart.

light treatment 9 Aug 98 to 8 Feb 99 (157 séances).

On the mucous membranes:

Sublimattemp., Iodine-Iodinepotassium, Galvanocaustic. No symptoms of illness since Febr. 99. Died 13 Oct 99 of Tub. miliary.

Medical report no. 130

No. 245

Shared apartment, 13 years, Jylland (Lund).

no tub in the family; patient ailing.

lup. vulgar since 2 years, starting from the nasal cavity, spread over the nose and a little on the upper lip and cheeks; 2-time scraping and thermocaustic without success

4 Jan 99. Frail appearance; tubes pulp. and albuminuria. The soft nose and the parts of the upper lip and both cheeks that lie closest to it are affected: significant swelling. Ulceration with partial defect of both nostrils, numerous nodules. -- Medium sized case.

. -- Narrowed nostrils, extensive ulceration in the nasal cavity with large perforation in Sept. cart.

Light treatment Jan 4 to Apr 24 '99 (94 séances). On the mucous membranes:

Sublimatamp., Nitr. argent. No symptoms of illness since April 99. Died July oo of Tub. pulp. and nephritis.

Medical report no. 131

No. 285

W'. G., 58 years old, married, Jylland (Country). no tub in the family; Patient previously healthy.

lup. vulgar 6 1/2 years old, started on the nose; slow growth on cheeks, neck and chin; previous lapis etching, ointments, 5x scraping and thermocaustic, all with little success.

20 Mar 99. Healthy appearance.

healthy appearance. Affected are the soft nose, the part of the left cheek closest to it, the largest part of the right cheek and further down the chin and neck: protruding, scaly nodules everywhere, merging on the nose, ulcerated in places. big case. Quite extensive ulceration in the nasal cavity with perforation in Sept. cart.

Light treatment March 20th to Aug. 19th '99 (146 séances). Simultaneously:

Pyrogall Ointment. On the mucous membranes:

Sublimattemp., Iodine-Iodinepotassium, Galvanocaustic. Since Aug: 99 no symptoms of illness. Died 27 Feb oo of pneumonia.

Medical report no. 132

No. 390th MG, 24 years, Sónderjylland (Land).

mother to tub. pulp. died; Patient in childhood scrofulous affections of the ear, eyes and cervical glands.

lup. vulgar for 10 years, started on the nose; slow spread to upper lip and both cheeks, treated with scraping and tuberculin without effect ; later homeopathic treatment.

17 Aug 99. Healthy appearance. The whole nose, large parts of the upper lip and both cheeks are affected. Superficial nodular affection, only the nose swollen, with partial defect of the nostrils. big case. Scars in the nasal cavity after the affection has healed.

Isolated nodules on gums and palate.

Light treatment 17 Aug to 14 Dec 99 (104 séances). On the mucous membranes:

Sublimattemp., Iodine-Iodinepotassium, Galvanocaustic.

March 10oo. Nice scar tissue everywhere, just a few knots. Mucosal affections not completely healed.

Light treatment March 10 to June 5 oo (73 séances) On the mucous membranes:

like in old times. No symptoms of illness when tendered. Died July 12, oo of typhus.

Medical report no. 133

No.484. Shared flat, 23 years old, married, Sónderjylland (country).

no tub in the family; Patient generally healthy.

lup. vulgar since 17 years, originated simultaneously on the face and both arms; very slow growth; occasionally treated with caustic ointments with temporary success.

15 Feb oo. healthy appearance. On both cheeks, left temple and both arms together II distributed, roundish lupus spots from pea to 2 mark large; scar tissue in the center, scaly nodules along the edges. Medium case.

Light treatment Feb 15 to Feb 27, May 1 to

June 23 oo (66 séances.) Simultaneously:

Pyrogall Ointment.

4 Jan 01. Nice scar tissue all over, just a few lumps.

Light treatment Jan 4 to Jan 16 01 (20 séances). No symptoms of illness since Jan. or. Died 11-May-02 of encephalitis.

Medical report no. 134

No. 563.

WG, 20 years, Falster (countryside). In the family of the mother Tub.; Patient used to be healthy, breast symptoms in the last year.

lup. vulgar since 1'14 years, started on the nose; later affection of both cheeks and right index finger; treated with lapis etching without success.

July 13 oo. frail appearance; tubes pulp. grav, on the bridge of the nose a rounded ulceration, approx. 1 cm, on the right cheek 2, on the left cheek 1 pea-sized nodule; a rounded ulceration on the right index finger,

small case. Light treatment July 13th to September 29th 00 (58 séances). No symptoms of illness since Sept. oo. Died March 30 oi of Tub. pulp.

approx.

cm.

Medical report no. 135

No. 744

Shared flat, 41 years old, Scotland (city).

no tub in the family; Patient previously healthy.

lup. vulgar since 6 years, starting from the nasal cavity; externally only slight affection, which is not treated.

July 9 on. Lean and pale appearance. Soft nose swollen, red, few nodes covered with scabs. small case. In the nasal cavity the affection has essentially healed, with perforation in Sept. cart.

Light treatment July 9 to Aug. 22, 01 (34 séances). On the mucous membranes:

sublimatamp. Potassium iodine, galvanic caustic. No symptoms of illness since Aug. or. Died March 02 of variola.

Ant. Kampf, Buchdruckerel, Jena.

Pictures of the patients before and after the treatment

by the institute's photographer

Miss Karen Rasmussen.

Lupus vulgaris no. 40. (Large case; healed, no recurrence since 28/8 99.)

message a. Finsens med. light institute.

photo ?

11 97

photo 15/11

98

Lupus vulgaris no. 67

(Very widespread case; healed, no recurrence since 15 reports. to Finsens med. Lichtinstitut.

1999.)

Lupus vulgaris no. 87. (Large case; healed, no recurrence since 19.00.)

Lupus vulgaris no. 97. (Big fall; healed 2/ 99, died "7 0C.)

17

photo ”,

98

message a. Finsens med. light institute.

10 99

Lupus vulgaris no. 124. (Medium-sized case; healed, recidivírei since ??/98.)

22

photo 23!

13 98

photo 16

message a, Finsens med. light institute.

piot. 28

98

4

Lupus vulgaris no. 133

(Very widespread case; healed, no recurrence since". 99.) Communication to Finsens med. Light Institute.

7

98

phot,

15

111 98

photo 1

Lupus vulgaris no. 111

(Very widespread case; healed, free of recurrence since 29 reports from Finsens med. Lichtinstiliit.

98.)

10

OF

pin code

/ 16

photo 15,

98

photo 20.6 98.

Lupus vulgaris no. 149.

(Very widespread case; cured since 00, died 01.) comm. a. Finsens med. light institute.

5

Lupus vulgaris no. 150. (Large case; healed, no recurrence since /.. 01.)

i 22

98

photo 15

25

photo ?

Lupus vulgaris no. 152.

(Very widespread case; cured since ".00; died : 01.)

message a. Finsens med. light institute.

IN

photo 14 & 98.

Lupus vulgaris no. 225

(Medium-sized case; healed, free of recurrence, according to information from Finsens med. Lichtinstitut.

99.)

Lupus vulgaris no. 230. (Large case; healed, no recurrence since: 99.)

photo 10

photo 28

00

Lupus vulgaris no. 252. (Small case; healed, no recurrence since "/, 99.)

C

message a. Finsens med. light institute.

i 99

3, c

OF 6!

Plot. 20

photo 30

01

S

99

Lupus vulgaris no. 276

(Medium-sized case; healed, no recurrence since 29. 99.)

Vitpart. a. Finsens med. light institute.

photo 31 :

8 99

photo

02

Lupus vulgaris no. 390. (Very widespread case; almost cured.)

message a. Finsens med. light institute. !

message, a. Finsens med. light institute.

11

Lupus vulgaris no. 143. (Large case; healed, no recurrence since ?/ 00.)

21

photo 21

11 99

message a. Finsens med. light institute.

message a. Finsens med. light institute.

Lupus vulgaris no. 474. (Very widespread case; cured"

01.)

message, a. Finsens med. light institute.

Lupus vulgaris no. 569. (Large fall; almost healed.)

Lupus vulgaris no. 599

(Medium sized fall; healed 266 01.)

mis

Lupus vulgaris no. 680. (Very widespread case; cured 25/11

message a. Finsens med. light institute

OUT

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I

Investigations of the histological effects caused by the light treatment of lupus vulgaris vulgaris

changes.

Of

Emil Wanscher.

The beautiful results achieved with FINSEN's light treatment for lupus vulgaris have of course prompted a series of histological studies on the effect of light on healthy and pathological skin by various researchers (MÖLLER, PILNOFF, GLEBOWSKI, LEREDDE, and Mac. LEOD). .

Before presenting the results which I have arrived at in the study of lupus vulgaris, I shall briefly discuss the work of the authors named.

FINSEN 1) experimentally examined the effect of light on tadpoles and found vasodilatation, emigration of red and white blood cells and contraction of red blood cells.

MÖLLER 2) caused an erythema solare s. photoelectricum on normal human skin by "hour exposure

1) FINSEN NR, Om de kemiske Straalers skadelige Virkning paa den dyriske Organisme. Hospitalstidende 1903, no. 44

2) MÖLLER, M., The influence of light on the skin. Bibliotheca medica. Dept. D., Issue 8, Stuttgart 1900.

Notices a. Finsens Medical Light Institute. VII,VIII. 1

HHI using a Glasberg crystal apparatus (light beams parallel, lamp 25 amperes). Biopsy 5 days after exposure. Microscopy: the epidermis was strongly altered, the corium was found rather unchanged. Epidermis infiltrated serously with intercellular exudation, the cells swollen with numerous mitoses, low leukocyte infiltration, only extremely few pigment-containing basal cells, stratum granulosum broader than normal. No change in keratohyalin grains. Stratum corneum is somewhat wider than usual, and a more or less broad belt of nucleated cells is also visible here. According to MÖLLERS, an abnormal keratinization process (parakeratosis) is caused by the effects of light (the ultraviolet rays and the visible part of the spectrum).

After exposure for one hour and subsequent sample excision five days after exposure, MÖLLER found: blistering in the epidermis, vasodilatation and bleeding in the corium. In experiments with rabbits he thinks he has obtained consistent results.

PILNOFF) has examined lupus vulgaris after one, two and three light treatments?) at different times after treatment. He found in the skin: hyperaemia, dilatation of the lymphatic gaps and lymphatic vessels, serous exudation, many white blood cells in the blood and lymphatic vessels, as well as leukocyte infiltration and penetration of white blood cells into the pathological cells, especially the giant cells.

1) PILXOFF, (Russki Wratsch 1902, p. 579). On histopathological changes in lupus vulgaris under Finsen's treatment. Res. by Arthur Jordan in the monthly journal for practical dermatology, vol. XXXV, no. 9.

2) Light source and treatment not specified in the paper.

When the immigrated cells are resorbed, vacuoles are formed in the protoplasm, which then perish. Gaps and cavities form between the cells. The effect is said to be most powerful three days after treatment. The author believes that the beneficial effect of light is based on the abundant migration of leukocytes into the lupus node and its cells.

GLEBOWSKI, A.'), who made sample excisions of lupus skin at different times after a different number of treatments with a fin lamp, finds:

24 hours after the light treatment: vasodilation and strong blood filling of the vessels, leukocyte migration, vacuole formation, especially in the giant cells.

48 hours after light treatment: The same changes as 24 hours after light treatment, but more pronounced and marked necrobiotic changes in cell nuclei, especially in giant cells, less marked in epitheloid cells.

Four days after the light treatment: arrest in the degenerative process of the granuloma cells. Eschar formation of the upper layers, strong fatty degeneration of the deepest cells in the epidermis.

7-12 days after light treatment: No clear difference between treated and untreated lupus tissue; there seem only to be more plentiful vessels than normal.

1) GLEBOWSKI, A., The changes in the lupus granuloma under the influence of the concentrated arc light according to the Finsen method (from the surgical clinic of Prof. Weliaminoff) Ref. Dr. C. Serapin (St. Petersburg): in negotiations of the German Dermatological Society, Breslau 1901.

from

Observations were approximately uniform whether examined after one or more treatments; the changes seemed to be more pronounced only after several séances.

After the end of the reaction, GLEBOWSKI finds that the granuloma elements decrease more or less clearly after only two séances, with the appearance of elongated, spindle-shaped cells.

GLEBOWSKI has directed his attention chiefly to the giant cells, which he finds to perish in vacuolation and fatty degeneration of the protoplasm after a number of treatments; on the average, he thinks, the giant cells have disappeared after 4-5 séances, and the epitheloid cells are about the same; only the necrobiotic changes are less evident in these cells than in the giant cells. He observed that the cells become elongated and does not rule out that the epithelioid cells participate in the cicatrization process, just as the lymphoid cells can participate. GLEBOWSKI found blood vessels in abundance, both in the tissue infiltrated with lymphocytes and in the lupus nodule; they obliterate after the formation of the connective tissue is complete. Fine elastic threads are found between the newly formed connective tissue.

SACK, A.') has criticized GLEBOWSKIS and PILLXOFFS work. While giving GLEBOWSKI unconditional credit, he doubts the accuracy of PILNOFF's phagocytosis theory, but adds in a footnote that, having seen PILNOFF's preparations, he confirms it

1) Munich medical weekly, volume 49, 1902, no. 27, p. 1141.

that PILNOFF's claims really are based on fact.

LEREDDE and PAUTRIER 1) have histologically examined erythema solare and the effect of light on normal human skin and in lupus vulgaris. LEREDDE exposed parts of his own skin and made test excisions at different times after the treatment. Lortet et Genoud's lamp was used for the experiments, exposure time 17 minutes. He finds the following changes:

For erythema solare: Slight exfoliation of the stratum corneun. In the Rete Malpighii, the spaces between the cells are somewhat larger than normal. Abundant nuclear divisions in the basal layer. Stratum granulosum normal. Cellular elements more abundant than normal in the corium and the connective tissue fibrils somewhat spaced. Vessels clearly dilated.

Normal skin: 15 minutes after the séance. Minor changes, some vessel dilatation.

24 hours after the séance: dilatation of the vessels and the perivascular lymphatic spaces. Moderate infiltration with lymphocytes, swelling of the fixed connective tissue cells, which are somewhat scattered and vacuolated. No change in the hair sacs .

Four days after the séance: thickening of the rete malpighii visible between the papillae under the bladder, leukocyte infiltration; in the depth small bubbles, which do not correspond to the large ones, besides an irregular mass of necrotic protoplasm. hair follicles intact. Slight changes in the corium. In some Papills the vessels have disappeared, in others they are dilated.

Eight days after the séance: Epidermis significantly thicker than normal, especially the stratum granulosum. Above this copious scab formation. In Rete Malpighii numerous cells with large nuclei; plenty of core division figures. No pigmentation. Hyaline swelling of the connective tissue fibrils in the corium. Cell division in the endothelium of the vessels, vessels extremely dilated.

In lupus tissue after repeated séances 14 days after treatment:

---

1) LEREDDE and PAUTRIER, Phototherapy and Photobiology. Role therapeutic and role biologique de la lumière, Paris 1902.

12-15 rows of cells in Rete Malpighii. Irregularly shaped cells in the stratum granulosum. papillae flattened. Abundant formation of connective tissue in the corium, large, dilated, thin-walled vessels. Few core divisions. In some places plentiful nuclei in the connective tissue and single plasma cells, in other places none.

The author claims to have found newly formed fixed connective tissue cells and assumes that this is the end result of light treatment in lupus.

MAC LEOD 1) carried out histological examinations on skin with lupus changes. In his first attempt he has a 4x4 engl. inch large lupus patch of upper arm used; the spot was divided into four pieces, which were examined before light treatment and 1-2-3 days after a séance. In his second attempt, he used a lupus patch of the cheek, treated three times with 14-day intervals; Excision 14 days after last treatment; clinically the spot was then flattened and improved, Lortet et Genoud's lamp, sessions 15 minutes long.

1) JMH MACLEOD), The pathological changes in the skin, produced by the Rays from a Finsen Lump. The british medical journal, Oct. 1902. First attempt: untreated lupus. Stratum corneum thickened, stratum granulosum defective, proliferation of the rete malpighii, granulomatous infiltration in the corium with plasma cells, small mononuclear cells and giant cells.

Lupus 24 hours after treatment. Little horn formation, in some places a weak tendency to desquamation. Rete cells vacuolated. Affects the cells in the hair follicles like the cells of the epidermis. Edema of all layers in the corium, marked vascular dilatation , infiltration with mononuclear cells, especially around the vessels in the superficial layers. No proliferation in the endothelium of the vessels. The plasma cells faintly stained, protoplasm shriveled around a swollen nucleus. The giant cells with vacuolation in the protoplasm. Between the edematous cells in the deeper layers both mononuclear and polynuclear cells were visible, which appeared to be healthy.

48 hours after treatment: edema more pronounced. In the epidermis, the vesicles were partially collapsed, more leukocytes, and the tendency to desquamation was more pronounced. Corium about like 24 hours after light treatment.

Three days after light treatment: edema almost gone, healing started. Keratohyalin in the stratum granulosum cells. A complete stratum corneum has formed. A number of plasma and giant cells have been destroyed in the corium, but they have recovered again in the deeper layers. No tendency towards reorganization of the cells could be observed.

Second attempt: epidermis fully regenerated after the edema. The cells appear healthy and stained like normal skin cells. Keratohyalin and a complete stratum corneum were seen.

Only in the deepest layers of the corium was there a distinct granuloma. Newly formed connective tissue in the superficial parts, no plasma or giant cells, but fine connective tissue fibrils in various stages.

In a résumé of his results, MAC LEOD states that he arrives at the same result as GLEBOWSKI.

to

Own investigations. In the histological study of a disease which is as polymorphous as lupus vulgaris, both macroscopically and microscopically, it is necessary, in order to be able to draw conclusions as to the effect of one or more light treatments, to obtain as homogeneous a material as possible

seek to obtain. I have therefore chosen a case of disseminated lupus in which the nodules clinically looked absolutely alike, and were at quite a considerable distance from each other. This form of lupus is, however, fairly rare on the extremities, where one can best afford exploratory excisions, which is why I have had only one case to deal with for the time being; on the other hand, this case lent itself well to histological examination, since clinically it was shown to be very resistant to light treatment, for which reason one will not easily obtain microscopic images which will lead to overly sanguine conclusions as to the curative effects of light.

I made exploratory excisions from the patient's upper arın, partly before the light treatment, partly 1, 8 and 14 days after a séance; also excision of a nodule from which, after six treatments, 18 days after the last treatment - only two small, deep pigmented spots remained; and finally excision of a nodule completely healed after six treatments, 20 days after the last treatment. The light treatment was carried out with a 60 amp lamp, Finsens 8 cm concentration apparatus, each séance lasted 70 minutes.

The preparations (partly celloidin, partly paraffin preparations in formol fixation) are stained with: Van Gieson's hematoxylin (Hansen's modification), hematoxylin-eosin, Weigert's fibrin staining, orcein-water blue, Unna's various methods with polychrome methylene blue, Pappenheim's method (Unna's modification)) and Mann's ?). Method.

A. Lupus vulgaris unexposed3).

The preparations show a large conglomerate of granuloma tissue, which is stored in a thick capsule of connective tissue, between the meshes of which small heaps of round cells, plasma cells, and epitheloid cells are found at depth. The entire granuloma tissue is covered by a very thin epidermis, which has only a very few rows of altered cells; in some places one can see some scales in the stratum corneum.

Similar granulation tissue just below the surface, but further down at depth, distinct, discrete small nodules are visible, in some places surrounded by thin connective tissue septa. Here there is ample development of vessels, which become more sparse towards the surface. Sweat glands intact, the duct continues upwards through the pathological tissue. Nowhere typical tubercle arrangement of the granulation cells, but scattered individual giant cells, copious amounts of epitheloid cells, which are found in heaps in some places, copious amounts of plasma cells. Some of the cells contain abundant chromatin, but no clear nuclear divisions anywhere. In the depth one sees some vessels, which are surrounded by a part of round cells.

1) Monthly journal for practical dermatology, vol. XXXV, no. 2, 1902. 2) MANN, Methods and Theory of physiological Histolog. Oxford 1902.

3) These as well as the following excised spots were completely identical in appearance, slightly scaly, reddish-brown, the size of a pea, and were distributed on the patient's untreated forearm.

B) Lupus vulgaris 24 hours after light treatment

The uppermost layer of epidermis came off with the bladder 1); I saw a thin layer of rete cells lying bare in the center mixed with pathological elements. Copious sero-fibrinous exudate pushing apart cells and bundles of connective tissue. The vessels, especially in the papillae, extremely dilated, abounding in red corpuscles, in some places so abundant that one might be led to suspect incipient thrombus formation; in other places one also finds large numbers of red blood-corpuscles outside the vessels. Heavy leukocyte infiltration in the upper layers, decreasing with depth. Both the relatively healthy cells in the epidermis and the granuloma cells are the site of vacuolating degeneration in the upper layers of the skin, while no significant degeneration is found in the deep layers. In the giant cells of the upper layers one can clearly see small clear vesicles in the protoplasm; in the other cells of the granuloma the change may be even more pronounced, as large cavities surrounded by a thin membrane are observed. In the epidermal cells the degeneration is less pronounced, a small, clear vesicle in a corner of the protoplasm. These changes and bleeding are extremely clearly visible with UNNAS and especially with MANNS color methods. No clear core division figures.

1) Bulla perished during the energetic skin disinfection, which I didn't think I could negligee and defend.

C) Lupus vulgaris 8 days after light treatment

Vacuolation and intercellular edema are still present. Somewhat declining granuloma tissue in the upper layers. The epidermis is seen partially regenerated in the marginal part, but the cells are atypical, so that it is difficult, indeed in some places impossible, to distinguish between rete cells and granulated cells; more towards the center of the preparations, epidermal cells are in proliferation and arrange themselves in strands, giving approximately the appearance of a network. Abundant mitoses. A few atypical epidermal cells on the papillae. Connective tissue protrudes from the sides under the epidermis, and streaks and clumps of granuloma tissue are observed between the connective tissue meshes. The hair follicles appear intact. The vessels are constantly greatly dilated, both red and white blood-corpuscles in large numbers outside the vessels.

D) Lupus vulgaris 14 days after light treatment

The reaction healed completely. Slight scab formation Epidermis greatly thickened, both the stratum granulosum and the rete malpighii; Plenty of keratohyaline. There are an extraordinarily large number of rows of cells, especially between the irregular, high papillae. Mitoses visible in some places. Abundant strips of connective tissue just below the epidermis, with diffusely distributed round cells between them. Visible under this layer of connective tissue are large conglomerates of connective tissue, containing plentiful individual giant cells, epitheloid cells and plasma cells. Constant strong vascular dilatation; small bleeding.

E) Lupus vulgaris after 6 light treatments, 18 days after the last séance.

The epidermis shows almost normal conditions, the individual layers of normal thickness. Corium papillae strongly flattened, strong dilatation of the abundant vessels. Beneath the epidermis is a wide strip of connective tissue, between whose cells are found a number of differently shaped but mainly elongated cells with distinct nuclei, and whose protoplasm contains numerous fine, strongly colored granules (young connective tissue cells?). About 2 mm below the surface there are two distinct nodules of epithelioid cells and round cells with a giant cell in the middle. These nodes are surrounded by a fine connective tissue capsule.

F. Lupus vulgaris after 6 light treatments, 20 days after the last séance.

Epidermis still entirely normal, layers of normal width, basal cells tall, cylindrical. papillae flattened. The connective tissue just under the epidermis appears to have fewer nuclei than normal. There are no pathological cells anywhere. Vessels constantly greatly dilated.

Proceeding from my own investigations, I shall confine myself to making the following remarks regarding the results of the earlier investigators:

I have not found any stopping point for PILNOFF's phagocythosis theory in my preparations.

Only in LEREDDE and PAUTIER did I find the enormous hyperplasia of the epidermal cells, which is clearly pronounced in certain stages of light treatment (examination D).

On the whole, my results are in agreement with GLEBOWSKIS and Mac LEODS, especially with regard to vacuolation of the cells; only I have nowhere, like GLEBOWSKI, found the lupus nodule interspersed with vessels; in Study E, where I found clear nodules after six light treatments, I observed nothing to suggest this.

The correctness of the observations, about which all earlier investigators agree, has also been confirmed by my investigations:

1. that severe vascular dilatation with extravasation

finds, 2. that cell killing, direct or indirect, particularly

ders of the pathological cells takes place, 3. that a new formation of connective tissue takes place;

Nothing definite is currently known about the genesis of these newly formed cells.

II.

About the effects of the electric arc light on tubercle bacilli in pure culture.

Of

Sophia Bang

At the Berlin Congress in 1890, R. Koch reported that sunlight is capable of killing tubercle bacilli in a few minutes to a few hours, depending on the thickness of the layer in which they are exposed to the light. Daylight worked in a similar way; albeit correspondingly more slowly, cultures of tubercle bacilli placed close to the window dying in the course of 5-7 days. Similar attempts were made by STRAUS?) in 1895; Pure cultures of tubercle bacilli exposed to sunlight on a balcony were killed within 2 hrs.; if the cultures were spread out in a thin layer on a glass plate, they were already dead after half an hour. Incidentally, these investigations, like later MiGNECO), MITCHELL and CROUCH), JOUSSET 6) and PETERSSON?)

1) Lecture ad tenth international med. Congress, Berlin 1899, Vol. I.

2) La tuberculose et son bacille, Paris 1895.

3) Proceedings of the Royal Soc. of London, Vol. LVI, 1894.

4) Archive for Hyg., Vol. XXV, 1896.

5) Ref. Journal f. diet. and physical therapy 1900, p. 156

6) C.r. de la Soc. de Biol. 1900.

7) North. medical Archive 1900, no. 30 & 33.

dealt with the practical-hygienic side of the question by examining the disinfecting effect of sunlight and daylight on sputum containing tubercle bacilli.

As far as I know, a determination of the killing time for tubercle bacilli pure cultures under the influence of a quantitatively and qualitatively precisely defined light has not yet been published. As some of the experiments I have made on this subject have, for external reasons, extended over a period of four years, the oldest of these experiments have been carried out according to methods which I have gradually abandoned as less reliable. Nevertheless, if I also describe these experiments in the following, it is done in order to be able to motivate the procedure in the newer ones more easily by illustrating the sources of error in the older experiments.

As at first I had no definite idea of the resistance of tubercle bacilli to electric light, I used the strongest possible light source then available to me, in order to have a better chance of having an effect with not too long an exposure time. In the first 3 series of experiments I therefore used the light of an electric arc lamp of 35 amps and 50 volts, which was concentrated by means of a quartz collector, the proportions and listing of which can be found in the experimental protocol (p. 10), and to which I also refer for the refer to other details. In the focus of this apparatus I applied an emulsion of pure cultured tubercle bacilli in the form of a hanging drop in RANVIER's chamber (R. I), or according to Koch's plate method (see below). After illumination, I inoculated the drop subcutaneously in guinea pigs.

The result was test series I (p. 10). that while the control animal (guinea pig no. 1) died of tuberculosis after 52 days, and guinea pig no. 2, which was inoculated with bacilli exposed to light for 5 min, after 45 days, the bacilli exposed to light for 10 min produced tuberculosis which was evidently retarded, in that the guinea pig concerned (No. 3) died of tuberculosis only after 102 days; the bacilli exposed to light for 15 minutes produced no tuberculosis (No. 4), and the bacilli exposed to light for 20 minutes produced tuberculosis that was in any case abnormal and very retarded (No. 5); in this case it could well be doubtful to what extent vaccination tuberculosis is present here. In row III, a slightly stronger effect of the light was achieved. While the two control animals died of tuberculosis after 41 and 57 days (No. 16 and 17), the 5 min Min. exposed bacilli (No. 21, 22, 23) did not cause tuberculosis.

During the execution of these experiments, the assurance of a constant light intensity had proved to be quite difficult, not only because the arrangement of the apparatus and the absorption conditions in the water used as a light filter could vary in the experiments, which were carried out at longer intervals, but also from The reason is that the intensity and composition of the light changes rapidly from the center to the periphery in the focus of the strongly chromatic quartz lenses. While this latter circumstance need not play a role in the exposure of areas which are larger in diameter than the focus, this may be the case in the exposure of areas of a few mm in size, such as e.g. B. in the hanging drop, in that a small change in the position of the drop can lead to a relatively large change in the intensity of the light. Since I suspected that the deviations regarding the effect of a 5-minute long exposure between row I and row III might be due to these circumstances, I switched to using unconcentrated light in the following experiments, which made the optical conditions clearer .

Another possible source of error was the difficulty in transferring the entire exposed droplet with the inoculating needle, and it was therefore to be feared that the amount of bacilli with which individual guinea pigs were inoculated could vary significantly. In order to be able to inoculate a reasonably constant quantity of bacilli, I used Koch's plate method in row III as well as in the next following experiments (R. IV and V), in which the finely ground tubercle bacilli were placed in agar (R. IV) or gelatine (R. V). were distributed, which was formed into a thin disk by pouring it out onto a horizontal glass plate. After curdling, small square pieces of appropriate size were cut from this disc and these were inoculated into the guinea pigs after exposure (or without prior exposure, as a control). In this way one could inoculate at will with an approximately constant quantity of bacilli, or (as in R. V) arrange it so that the longest exposed bacilli were inoculated in larger quantities; if the guinea pig in question remained free of tuberculosis, the effect of the light was all the more obvious. Exposure was made in said rows IV and V at 28 cm from a 35 amp arc lamp (see also p. 13 and p. 16). Notices a. Finsens Medical Light Institute. VII, VIII. 2

Row IV was exposed in this way for up to 40 min (guinea pigs #24-32) without ever succeeding in killing the bacilli. After 30 and 40 min exposure, the bacilli appeared to produce somewhat delayed tuberculosis (guinea pigs 30 and 32). Since the agar disc used had a somewhat milky appearance and it was therefore assumed that quite a lot of light was absorbed by it, a gelatine that was as light as possible was used in row V, which after emulsification of the bacilli to a 1/4-1 /3 thick slice poured. As a result of the experiments made herewith, it was found that . that while the control animals died of tuberculosis after 30 and 39 days (Nos. 33 and 35), in one case (No. 37) the bacilli exposed for 40 minutes did not produce tuberculosis, while in the other case one was visibly retarded Tuberculosis was diagnosed (No. 36, died after 81 days, with retractions in the liver and spleen). The bacilli exposed for 50-75 min. gave no tuberculosis in 7 of 8 cases (Nos. 38, 39, 40, 42, 43, 45, 47); in one case, after 75 minutes of exposure, a significantly retarded tuberculosis developed (No. 44, died 111 days after exposure).

In the following experiments (R. VI-IX) Koch's plate method was no longer used, but the bacilli were spread as a thin layer on the surface !) of agar plates, with the intention of reducing the light absorption in the medium in which the bacilli were during the exposure were to decrease even more. A tubercle bacilli emulsion was poured onto a thin agar plate; after a suitable degree of drying (cf. Experimental protocol), small discs were removed from the agar plate for loading

1) See communication. a. Finsens med. light inst. Vol. III p. 97.

time on.

clearing and inoculation cut out. A microscopic examination of vertical sections of hardened plates of this kind showed that the tubercle bacilli lay as a thin, even layer on the surface of the agar, without having penetrated anywhere into it.

As was to be expected from the outset, it was possible in this way to kill the bacilli in a significantly shorter time than in the previous experiments. While the kill limit according to R. IV and V should be in the region of 40 - 50 min (at a distance of 28 cm from the light source), R. VI and VII (where the distance from the light was 30 cm) hardly indicate one half the size kill

Namely, in row VI, the bacilli exposed to light for 20 min did not give rise to tuberculosis (No. 59); after 15 minutes of exposure, a visibly retarded tuberculosis developed (No. 58). To what extent the bacilli exposed for 8 and 10 minutes had been influenced by the light can be doubted. Bacilli exposed for 1-5 min (No. 50-55) gave rise to tuberculosis with the same course as in the control animals (No. 48 and 49). - A similar result was given by row VII. Of the two guinea pigs vaccinated with 15 min. exposed bacilli, one was free from tuberculosis (No. 69), while the other (No. 70) was a few months longer than the controls (No .60 and 61) lived. The bacilli which were exposed for 1/2-10 min. (Nos. 62 to 68) all produced fatal tuberculosis, but a few guinea pigs (Nos. 63 and 64) lived remarkably long, although the exposure in these two cases was only I and 2 min.

This latter circumstance that 1 and 2 min. exposure seemed to act on the bacilli in certain cases, while in other cases 5 or 10 min. exposure

The method apparently had no effect was a sign to me that the method still had significant sources of error. I thought I would find one in the following circumstances: by cutting out the small agar disks, on the surface of which the tubercle bacilli were located, from the common larger plate and by attaching them to RANVIER's chambers with a platinum wire needle or something similar, it was difficult to resist to ensure that some bacilli were carried along on the edge or underside of the agar discs; here they would be relatively sheltered from the light, and after inoculation might transmit tuberculosis to the guinea-pig, though the bacilli lying on the surface might all have been killed by the light. Although I had already drawn my attention to this possibility in rows IV and V (see experimental protocol), it was clear to me that the technique used did not provide sufficient guarantees. It wasn't until Series VIII that I used a method that seemed to give me a guarantee. After the bacilli emulsion had been spread evenly over a sterile agar plate about 40 cm in size, discs of 10 mm in diameter (9: significantly larger than the discs to be inoculated) were cut out with a sharp-edged brass ring. The underside of these disks could now be safely grasped with forceps, provided that one held close to the edge of the disk and brought it with a vertical movement into RANVIER's chamber, the shape and size of which was so adapted that the disk could not be shifted from side to side. After the exposure, a small disc was punched out in the center of the large one using a tube with a diameter of 4 mm. The bacilli lining the edges of this little tube along the sides of the disk could carry with them, all were exposed in this way and could not influence the results. A similar result was obtained in Row IX by, after Dr. JANSENS suggested using a platinum wire eyelet to spread the emulsion onto the surface of the sterile agar disks placed in situ in RANVIER's chambers. This method is less cumbersome than that used in row VIII, but it assumes that the number of bacilli need not be exactly equal in each experiment?).

Experiment series VIII and IX. 30 Apère, 50 volts, 30 cm distance, 50° beam angle,

30° C., tubercle bacilli in surface cultures.

guinea pig

chen No. Lighting time in minutes

result

annotation

82 83

84

71

0 died from Tub. 72 0 Died of Tub. 80 0 Died from Tub. 81 0 Died of Tub.

3 Retarded Tub.

6 No tube.

9 Severely Retarded Tub.

73 10 No Tub.

85 12

74

15 No tube. 75 15 No Tub. 86 15 No Tub. 76 20

no tub 20 No Tub. 77 25 No Tub. 78 25 No Tub. 79 30

?

'/ year killed after vaccination

do.

do. 42 year after d. Vaccination died of an epidemic. Died 5 days after vaccination. 1/2 year after d. Vaccination under an epidemic died.

do. Killed 1/2 year after vaccination. 1 month after d. Vaccination died, autopsy negative Killed 14th yr after vaccination. 1/2 year after d. Vaccination unt, an epidemic died.

87

do.

Doubtful cause of death. Hardly any vaccination tube.

1) Whether the abnormal fact that the guinea pig no. 84 contracted tuberculosis while No. 83 remained tuberculosis-free, based on this relationship

were.

From the above one would expect that rows VIII and IX would show an even lower kill limit than rows VI and VII killed

In experiment 84 they were not all killed after 9 minutes of exposure; but partly the tuberculosis confirmed here was only of small extent and very backward in its development (a few, small nodules in the liver at a time when the control animals had already died of tuberculosis), and partly the experimental errors, as mentioned, and how Incidentally, it is probably in the nature of things to mostly go in the direction of reducing the lighting effect. Since, in addition, the bacilli exposed for 3 minutes (No. 82) had already shown a visible effect of the light, the conclusion seems justified to me that the killing limit for tubercle bacilli, which under the given circumstances are exposed to the light of a 30 amp arc lamp at a distance of 30 cm be exposed to look for at 6 min, possibly between 3 and 6 min; by conceding for the time being that 9 minutes of exposure does not always have a killing effect.

Since it has been of primary importance to me to investigate to what extent the relation of the tubercle bacilli to the light is essentially of

lead, or is based on other circumstances, can hardly be decided without experimentation, so until then the method used in Series VIII must probably be regarded as the most reliable. In No. 79 probably had no vaccination tuberculosis (see test protocol p. 38); but even if it were, this one positive case could not outweigh the many negative ones, besides which a comparatively small experimental error might give a positive result of the vaccination.

different or not different from the other bacteria hitherto examined, I have found no reason to determine the limit of killing with any greater accuracy than that attained here. I have previously found the corresponding killing limit for Staphylococcus pyogenes aureus (see communication from F.m.L. Vol. III, p. 97) using a 30 amp arc lamp at a distance of 60 cm (1st c. p. 105), found lying at about 14 min. At a distance of 30 cm, as in these experiments, the lethal limit for Staphylococcus should be 14:4=34/2 min. There is therefore no reason to suppose a very important difference in the resistance of tubercle bacilli and Staphylococcus to the light.

test protocol. Series I (28)1898).

light source. The light from an electric arc lamp, 35 amps and about 50 volts, was collected with a quartz collector, the first lens surface of which was 12 cm. from the arc. The diameter of the front lenses was 6.5 cm, their focal length 30 resp. 20 cm; the thickness of the water layer 30 cm. The exposure took place at the point where the cone of rays had a cross-section of 1.5 à 2

cm had.

The collecting apparatus was placed at an angle of 50° to the axis of the coals.

The tubercle bacilli were taken from a 4-week-old culture of the strain used at the Agricultural College for tubercle preparation. A heap of germs was rubbed out in an agate mortar at Boullion. A

1) The same, which in Mitt. a. Finsens med. Lys Institute, Vol. II, p. 12, to which reference is also made with regard to carbon thickness, regulation, etc.

Drops of this emulsion were applied as hanging drops behind a coverslip in RANVIER's chamber. During the experiment, cold water was sprinkled over the cover slip placed perpendicular to the axis of the collecting apparatus. - The experiments showed that the setup of the RANVIER chamber was not sufficiently stable, so that the exposed drop did not come to the same spot of the focus every time.

Vaccination was carried out subcutaneously in the right gluteal region of guinea pigs immediately after the end of the experiment. Bandage with cotton and collodion.

! 10

110 98

Guinea pig no. 1. control animal. vaccinated d. 28/8 98 with a loop of unexposed emulsion. Weight 530g Died 19/

98. Weight 392g. Section. In the right groin one caseous gland the size of a nut and two the size of a hemp seed. The liver was greatly enlarged, almost entirely collapsed. flowing cheesy masses. The spleen was greatly enlarged, with numerous, partly confluent, cheesy masses. The kidneys and intestines were natural. In the lungs there were only 2-3 nodules the size of hemp seeds, a single one of which was caseous.

Guinea pig no. 2. Inoculated 28/8 98 with a loop of emulsion exposed for 5 min. Weight 460g

died 12

Section. On the right side 3 glands the size of a pea, one of which was caseous. In the liver there were numerous confluent cheesy masses, but not a few healthy portions. The spleen was the same. A few fresh tubercles were found in the lungs. The kidneys and intestines were natural.

Guinea pig no. 3. Inoculated 28/6 98 with a loop of emulsion exposed for 10 min. Weight 425g

Died 8/12 98.

Autopsy: Two pea-sized glands in the right groin. The liver is not very enlarged, thin, sharp-edged, with comparatively large, firm, cheesy portions, which are not numerous, and have very large portions of healthy tissue between them. The spleen is scarcely enlarged, with similar isolated caseous portions, with very profuse healthy tissue between them; In the middle of the liver one notices a transverse indented furrow, which appears to consist of connective tissue. In the lungs one notices very sparsely distributed cheesy nodules, some of them the size of a pea and of a hard, whitish, cartilaginous consistency [Tub?].

Guinea pig no. 4. Inoculated 28/8 98 with a loop of emulsion exposed for 15 min, weight 410 g.

Killed 29/4 99.

Section: fat, well-fed. No swollen glands in r. Strip. In the liver, 3-4 poppy-seed-sized, white nodules of an indefinable nature are noticeable in a single spot. Spleen, kidneys, intestines, lungs of course.

Guinea pig no. 5. Inoculated 28/8 98 with a loop of emulsion exposed for 20 min. face 387g

Died 11%, 99.

Section: No swollen glands in r. Strip. liver was somewhat enlarged; on the surface one observes about 50 iniliary up to hemp-seed-sized fresh nodules; also 3-4 more than hemp-seed-sized, cartilaginous, hard, angular nodules, one of which shows a well-defined emollition in the middle. Spleen greatly enlarged with about 10 miliary nodules up to the size of poppy seeds. In the first lung, a collection of barely hemp-seed-sized, white nodules was observed near the base. Whole first lung is atelectatic with isolated nodules other than those mentioned. L. Pleural cavity filled with large caseous-whitish empyema. in the right Lung 4-5 miliary white nodules. heart, kidneys, abdominal skin, intestines without tub.; Stasis in kidneys, liver and spleen.

Series II (13/u 1898).

Guinea pig no. 6-15 were inoculated partly with unexposed tubercle bacilli, partly with tubercle bacilli that had been exposed for different lengths of time. Upon microscopic examination of the somewhat peculiar-looking culture immediately after inoculation, it was found that it was heavily contaminated with a yeast fungus. Corresponding to this circumstance, culture has been greatly weakened; for the control animal appeared to have lived in the best of health until May 2, 1899, when it was killed. Autopsy showed great enlargement of the right inguinal gland, which was caseous on average. Insignificantly old tubules were found in the liver. with fresh miliary nodules. Otherwise no clear tub. Guinea pig no. 10 died on ?/6 99. It was on

98 inoculated with tubercle bacilli which (as in the previous series of experiments) had been exposed to light for 1 minute. Autopsy revealed no tub. in the groin glands. Scattered, cheesy nodules and isolated hard, greasy, fibrous patches in the liver. Spleen enlarged, with doubtful, cheesy mass. In the mesentery, nut-sized, partly fibrous, partly caseous glands. Isolated nodules in the lungs.

The remaining 8 guinea pigs were killed on ?/6 99 and all found healthy at autopsy.

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Series III (4/12 1898).

Light source as in row I. 50 volts. quartz collector.

Amperage 35 5 Amp. with approx.

The tubercle bacilli were obtained from a 6-8 week old culture from the agricultural college. The bacilli were carefully ground in an agate mortar and spread in agar (clot temp. ca. 40"), which thereby became gray, milky from bacilli. Sterile agar was then formed into a ca. 1 mm thick plate, from which square pieces were cut out (ca. 3 x 3 mm), each exposed in its own RANVIER chamber, fixed in a special apparatus. Cold water was irrigated during exposure. The agar plate was placed on the back of a "coverslip" which in some cases glass, in others quartz (see below).

Inoculation of the agar plates was done subcutaneously in one poche in r. Regio glutaea made on guinea pigs (also in the following test series).

12

30/

Guinea pig no. 16. Control animal. Inoculated 412 98 with an unexposed agar disk. Weight 570g

Died 14%, 99.

Section: In r. Bare bean-sized, cheesy glands. Typical liver, marbled with cheesy masses. spleen as well. In the lungs only a few clear nodules, hardly the size of hemp seeds.

Guinea pig no. 17. Control animal. Inoculated on /1.98 with an unexposed agar disk. Weight 570g

Died on 9% 99.

Section: In r. Well pea-sized, cheesy glands. Especially in the liver, numerous cheesy masses and nodules the size of hemp seeds. Nilz-like appearance. Numerous nodules, hardly the size of hemp seeds, in the lungs. In the middle of the r. Lung a pea-sized flat, white, fibrous nodule. A nodule the size of a hemp seed on the perecardium.

Guinea pig no. 18. Inoculated on 1/2 98 with an agar disc exposed under quartz blanket for 5 min. Weight 415g

Died 9% 99.

Section: In r. Well pea-sized, cheesy glands. In the liver numerous cheesy masses, which are not very extensive and far from confluent. In the spleen only miliary nodules and small, non-cheesy nodules the size of hemp seeds. Barely hemp-seed-sized nodules in the lungs.

Guinea pig no. 19. Inoculated on 1/12 98 with an agar slide exposed under coverslip for 5 min. Weight 415g

Died */4 99.

Section: In r. Well pea-sized, cheesy glands. In the liver numerous, but not confluent, cheesy masses. In the spleen some

/12

small knots, no cheesy masses. Barely hemp-seed-sized nodules in the lungs.

Guinea pig no. 20 died of infection shortly after vaccination.

Guinea pig no. 21. Inoculated on 12 98 with a coverslip exposed agar disc for 10 min. Weight 370g Killed 15

99. Weight 520g. Autopsy: Healthy, apart from the fact that the liver has very isolated, greyish, fine star-shaped connective tissue points the size of millet seeds in clearly retracted tissue with no trace of tub. showed. in r. Don't get glandular.

Guinea pig no. 22. Inoculated on /12 98 with an agar disc exposed under a coverslip for 15 min. Weight 330g

Killed 5/12 99. Weight 520g.

Section: Healthy, no sign of Tub. No glandular tumor in r. Strip.

Guinea pig no. 23. Inoculated on 12 98 with an agar disc reported under cover quartz 15 min. Weight 510g

Died 20% 99, cause unknown.

Section: No sign of Tub anywhere. No swollen glands in r. Strip.

28 cm.

Series IV (13/3 1899).

While in the previous test series the exposure was made with concentrated light, in this series, as in all the following ones, it consisted of unconcentrated arc light. The exposure was made in a photoctetometer 1) placed at an angle of 45° to the axis of the carbons, at a reduced distance

The lamp burned with 35 amps and 50 volts. The cultures were kept at 30°C during exposure.

While the tubercle bacilli used in rows II and III were 6 and 8 weeks old, here a 34/2 week old culture freshly fetched from the agricultural college was used. After trituration in the agate mortar, the bacilli became

mm thick agar plates, which were exposed behind a thick quartz blanket and then inoculated into the animals.

in approx.

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mm 13

Guinea pig no. 24. Inoculated on 13/3 99 with unexposed agar disc; so control animal.

Weight 450g

Died_26/99.

1) See communication from Finsens med. Lys Institute Vol. II, p. 1.

29

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Section : In r. Bare two bean-sized, cheesy glands. Liver consists of confluent, cheesy masses. spleen likewise. Two mesenteric glands are hardly the size of a pea, greasy, with small cheesy parts. Lungs, kidneys, intestines healthy.

Guinea pig no. 25. Inoculated at $'99 with a 5 min lighted agar disc. Weight 395g

Died ?1/4 99.

Section: In r. Bare bean-sized, cheesy glands. Liver consists of confluent, cheesy masses. Spleen with few caseous parts. Several hemp-seed-sized, a single nut-sized, caseous mesenteric glands. Lungs, kidneys, intestines healthy.

Guinea pig no. 26. Inoculated on 13/3 99 with a 10 min lighted agar disc. Weight 370g

Died ?9/ 99.

Section: In r. Well bean-sized, cheesy glands.

Liver with confluent, cheesy masses. Spleen particularly enlarged, with numerous caseous nodules the size of hemp seeds. Very isolated tubercles, hardly the size of hemp seeds, in the lungs. Healthy kidneys and intestines.

Guinea pig no. 27. Inoculated on 13/3 99 with a 15 min lighted agar disc. Weight 365g

Died ?. 99

Section: In r. Well bean-sized, cheesy glands. Liver with confluent, cheesy masses. Numerous miliary nodules and small caseous masses in the spleen. Lungs, kidneys, intestines healthy.

Guinea pig no. 28. Inoculated on 13/3 99 with a 20 min lighted agar disc.

Weight 450g

Died 5/6 99.

Section: In r. Barely bean-sized, cheesy glands Liver shows confluent cheesy vessels, which are not very extensive. Spleen greatly enlarged with numerous tubercles hardly the size of hemp seeds. Lungs, kidneys, intestines healthy.

Guinea pig no. 29. Inoculated on 9/3 99 with a 25 min lighted agar disc.

Weight 340g

Died 12/4 99.

Section: In r. Well pea-sized, cheesy glands. In the liver numerous nodules that do not flow together, only a few of which are larger than hemp seeds; one sees individual places of cheesy mass. Spleen greatly enlarged, composed entirely of confluent caseous masses. Few fresh miliary nodules in the lungs. "Quite severe tuberculosis, which is hardly the only cause of death."

Guinea pig no. 30. Inoculated on 13/7/99 with a 30 min lighted agar disc. Weight 340g

13/

Died 8% 99.

Section: In r. Well bean-sized, cheesy glands. In the liver numerous cheesy parts, which, however, only flow together in places. The edge of the liver and the caseous parts show in several places retracted parts with a fibrous appearance. The spleen consists of extensive, solid, strongly confluent, cheesy parts. In the lungs not a few miliary tubercles up to hardly the size of a hemp seed. A few mesenteric glands are swollen, a single one with a cheesy patch the size of a hemp seed. kidney healthy.

Guinea pig No.31 died of acute infection after vaccination.

Guinea pig no. 32. Inoculated on 18/2 99 with a 40 min lighted agar disc. Weight 450g

Died 21/6 99.

Section: In r. Well bean-sized, cheesy glands. The liver consists of confluent, caseous masses; their undersurface has a shriveled appearance reminiscent of cirrhosis of the liver. The spleen consists entirely of confluent, caseous masses. In the lungs numerous tubercles the size of hemp seeds. kidneys, intestines healthy.

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Series V (21/6 1899).

Exposure to unconcentrated arc light in photocteinometer at 20° with a 25 amp, 50--52 volt lamp at 28 cm distance, at an angle of 45° to the axis of the carbons, with a 25 mm layer of water in front of the culture.

Tubercle bacilli: about 5 weeks old, just gotten from the agricultural college; after rubbing in an agate mortar, they were cast in a layer of gelatine 1/4-1/3 mm thick. Squares were cut from this, approx. 3 x 3 mm x 4 x 4 mm. The largest squares were exposed the longest. quartz ceiling. After exposure, they were inoculated subcutaneously in the r. gluteal region.

Guinea pig No.33. Inoculated on 21/5 99 with an unexposed gelatin disc; so control animal. Weight 420g

Died 29/6 99.

Section: In r. Bare bean-sized, cheesy glands. Liver and spleen composed entirely of confluent cheesy masses. Lungs and other organs healthy.

Guinea pig No. 34. Control animal, died the day after vaccination.

Guinea pig N0.35. Inoculated on 99 with unexposed gelatin disk; so control animal. Weight 400g

Died 2% 99.

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Autopsy: cause of death perhaps partly superficial, very widespread ulceration on the back (bite, etc.). in r. Bare bean-sized, cheesy glands. Cheesy parts in the liver, numerous small tub. Node. Particularly numerous in the spleen. Node. Lungs and other organs healthy.

8th

Guinea pig no. 36. Inoculated at 21% 99 with a 40 min exposed gelatin disc. Weight 430g

Died 1% 99.

Section: In r. Groin larger than bean-sized, caseous glands. The liver consists of confluent, caseous masses; the organ has a firm, greasy consistency with strongly developed connective tissue traits, reminiscent of cirrhotic shrinkage. The spleen rather firm "cirrotic" with numerous, large, cheesy parts. In Oment, Maj. and Lig. gastrolia. isolated miliary nodules; Peritoneum otherwise free. Individual caseous mesenteric glands. Quite large serous ascites, intestine of course. Numerous miliary nodules the size of hemp seeds in the lungs. Well hemp-seed-sized, cheesy bronchial glands.

21

V 99 with a 40 min.

Guinea pig no. 37. Inoculated on exposed gelatin disc. Weight 280g

Killed 15/12 99. Weight 260g.

Autopsy reveals nothing abnormal.

Guinea pig no. 38. Inoculated on 215 99 with a gelatin disc exposed for 50 minutes. Weight 430g

Killed 15/12 99. Weight 470g.

Autopsy reveals nothing abnormal.

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Guinea pig no. 39. Inoculated on ?1/3 with a 50 min exposed gelatin disc. Weight 380g

Killed 6/12 99. Weight 500g.

Autopsy: No symptoms of Tub. About 20 connective tissue retractions the size of millet seeds can be seen on the surface of the liver, some circular, some star-shaped. When cut, one sees that they consist of pure connective tissue; in a single place one notes a submiliary white nodule, which microscopically consists of pure connective tissue.

Guinea pig no. 40. Inoculated on 25 99 with one of the slightly larger gelatin discs after 60 minutes exposure. Weight 300g

Killed 15/12 99. Weight 510g.

Section: No distinct tub. Only in the liver are individual submiliary, white nodules observed, which cannot be seen microscopically. same,

Guinea pig no. 41 died the day after vaccination.

Guinea pig no. 42. Inoculated on ?/ 99 with one of the smaller gelatin discs after 60 min exposure. Weight 350g

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Killed 18/12 99. Weight 410g.

Autopsy reveals nothing abnormal.

Guinea pig no. 43. Inoculated on ?/ 99 with one of the smaller gelatin discs after 60 min exposure. Weight 310g

Killed 15/12 99. Weight 410g.

Autopsy reveals nothing abnormal.

Guinea pig no. 44. Inoculated on 915 99 with a gelatin disc exposed for 75 minutes. Weight 400g

Died 7, 99.

Section: In r. Bare bean-sized, cheesy glands. Cheesy masses confluent in the liver and spleen, but not of maximum extent. Bronchial glands enlarged, greasy, not cheesy. The lungs are healthy, by the way, as are the intestines and kidneys.

Guinea pig no. 45. Inoculated on 6 99 with a gelatin disc exposed for 75 min. Weight 330g

Died 29% 99.

Autopsy reveals nothing abnormal. Cause of death unknown.

Guinea pig no. 46 died shortly after vaccination.

Mecer pig no. 47. Inoculated at 21% 99 with a 75 min exposed gelatin disc. Weight 390g

Killed 15/12 99. Weight 470g.

Autopsy reveals organs normal. Only on a single lobe of the liver are continuous connective tissue bands surrounded by star-shaped retractions.

21

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Series VI (16/3—17/1901). Exposure of surface cultures.

Exposure (on the 13/3 evening) with unconcentrated arc light in a photoctetometer at a distance of 30 cm with 30 amps and 51-52 volts, at 274/2-30° C., at an angle of 50° to the axis of the carbons. quartz deck.

tubercle bacilli. A small piece of a culture created on 13/2 is rubbed sterile in 1/4 hour in a test tube sealed with cotton using a rough glass rod, and then in 4 cm 0.7% NaCl-Opl. glutted. (The resulting emulsion is more finely divided than that previously used and has an opacity approximately that obtained by 2 drops of 1/10 normal silver nitrate solution in 4 cm 0.7% NaCl opl.). After the emulsion has stood for 2 hours, it is filtered through a funnel in the tube of which is placed a plug of hydrophilic cotton. In the slightly milky filtrate

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one sees neither macroscopically nor microscopically clustered bacilli. A suitable amount of the filtrate is spread on the surface of a plate of 2% agar (without nutrients) approx. mm thick; The attempt is made to dry the liquid layer by standing in the desiccator at room temperature for 12 hours, and then at 300 for four hours, but since it has not yet dried completely, the air in the dessiccator is diluted for an hour by means of a water-air pump, after which no freely moving liquid appears the surface is noticeable.

Small squares are cut out of the agar plate treated in this way; such are transferred with a flat platinum wire, which is passed under one corner of the square, and with the aid of which they are placed in a hollow-ground slide, and covered with a quartz cover.

After exposure, the corner touched by the platinum wire is cut off, as the possibility might be thought that bacilli might have been introduced under the agar by the platinum wire. Then subcutaneous inoculation in r. Gluteal region of guinea pigs. Because of an accident with the preparations exposed first, exposure and inoculation were only carried out in the morning, so that the prepared but unexposed plate lay overnight.

Guinea pig no. 48. Inoculated at 17:01 with unexposed agar disc; so control animal. Weight 665g Killed 16 01

Weight 490g. Section: In r. Groin almond-sized, caseous glands. The liver shows almost confluent nodules, scarcely the size of a hemp seed, beginning to form cheesy masses. spleen as well. A few clear nodules in the lungs.

Guinea pig no. 49. Vaccinated "?, or with unexposed agar disc, i.e. control animal. Weight 585 g.

Killed 16 01. Weight 555 g

Section: In r. Groin larger than almond-sized, caseous glands. In the liver numerous nodules, hardly the size of hemp seeds, confluent here and there; no big cheesy masses yet. spleen as well. In the lungs, quite numerous, clear nodules up to the size of a button pin head. Kidneys etc. healthy.

Guinea pig no. 50. Inoculated on "z on with a .min. exposed agar disk. Weight 575 g. Killed 7601.

Weight 540 g Section: In r. Groin almond-sized, caseous glands. In the liver numerous tubercles, the size of a pinhead, beginning to coalesce

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cheesy masses. The spleen shows very numerous tub. Node. Quite numerous, gray nodules in the lungs.

Guinea pig no. 51. Inoculated on 1/2 oi with 1 min lighted agar disc, weight 565 g. Died 6/6 01.

Weight 477g Section: In r. Well, almond-sized, cheesy glands. Quite numerous non-confluent miliary tubercles in the liver. No cheesy masses. Spleen as well, but here the nodules are merging in places. Isolated miliary nodules in the lungs; in addition, bronchopneumonia in the uppermost lobes of both lungs, which microscopically show no tubules. A few miliary, white dots of an indefinable nature can be seen on a single loop of small intestine. kidney healthy.

Guinea pig no. 52. Inoculated on 11/3 or with a 2 min lighted agar disc. Weight 555g Killed % or.

Weight 590g. Section: In r. Groin almond-sized, caseous glands. Abundant in the liver and spleen. Knots, without cheesy parts. A few clear nodules in the lungs.

Guinea pig no. 53. Inoculated at 1/3 of a 3 min lighted agar disc. Weight 545g Killed ?% 01.

Weight 470g Section: In r. Groin almond-sized, caseous glands. In the liver numerous hemp-seed-sized, yellow tubercles, beginning formation of caseous parts; similar in the spleen, but less numerous. A few clear nodules in the lungs.

Guinea pig no. 54. Inoculated on 13 or with a 4 min lighted agar disc. Weight 520g

Died 6% 01. Weight 312 g

Section: Severe pediculosis. in r. Barely the size of a bean, the glands are very caseous and emollient. In the liver 10 well-defined, caseous nodules the size of a pinhead and somewhat larger, bright yellow. No doubt fresh miliary nodules anywhere. The spleen does not want to be ruptured, shows 10 clusters of yellowish nodules the size of a button pin head. In the lungs very profuse, fresh, small, semi-clear miliary tubercles. gut of course.

Guinea pig no. 55. Inoculated on 13 or with a 5 min lighted agar disc. Weight 530g

Killed % 01. Weight 440 g

Section: In r. Bar 2 cheesy glands the size of a coffee bean. In the liver very numerous nodules with the beginning formation of cheesy areas. In the spleen very numerous but rather small nodules. Caseous bronchopneumonia in the 1st uppermost lobe of the lung.

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8th

Guinea pig no. 56. Inoculated on ??/: 01 with an 8 min lighted agar disc. Weight 460g Killed 6 01

Weight 470g Section: In r. Groin glands the size of almonds. In the liver there are isolated small, cheesy, but not yet yellow, islets the size of hemp seeds or coffee beans. Hardly any isolated knots. Infection not particularly widespread. In the spleen very numerous, almost confluent, nodules the size of a button pin head. Bronchopneumonia with incipient caseation in the first uppermost lobe of the lung; otherwise lungs free. kidney healthy. (Nowhere fresh miliary tub.)

Guinea pig no. 57. Inoculated on the "/goi with a 10 min. exposed agar disc. Weight 520 g.

Killed 01. Weight 555g

Section: In r. Bar glands about the size of a coffee bean. In the liver isolated, not particularly numerous, nowhere confluent tub. Node. In the spleen very numerous, in places confluent, nodules the size of hemp seeds. A few clear nodules in the lungs. kidney healthy.

Guinea pig no. 58. Vaccinated on *?/; oi with a 15 min. exposed agar disk.

Weight 450g

Killed 76 01

Weight 560g

Section: In r. Barely have glands the size of coffee beans. In the liver

In the spleen, about 10 small, well-rounded, yellow nodules. which is not enlarged, only a few doubtful tubercles. Lungs and kidneys normal.

Guinea pig no. 59. Inoculated on 11/3 or with a 20 min lighted agar disc. Weight 605g

Killed 01/01. Weight 460 g.

Section: No swollen glands in r. Strip. Liver apparently healthy, milky in a single spot, a few miliary nodules can be seen here, which cannot be seen microscopically. looking similar. spleen also microscopically, of course). lungs and kidneys healthy.

Series VII (30/3 1901). surface culture.

Exposure to unconcentrated arc light in a photoctetometer at a distance of 30 cm with an emission angle of 50°, at 30 amps and 51 (50-82) volts, at 29-30° C. Quartz deck.

tubercle bacilli. Spread on the surface of a horizontally poured agar plate as in row VI. 1 cm3 of a filtered culture is dried by spending four hours in a desiccator at 37°, then staying at room temperature for 12 hours and staying at 37° for a few hours. Slices are cut from the plate using a sharp-edged tube with a cut-out on one side, so that the disc that has been cut out is given a handle by which it is held in order to be transported to the relevant cover quartz. After exposure, this stalk is cut off because it could possibly also contain bacilli on the underside. While in the previous experiments the disks were exposed lying on the floor of the humid chamber, so that the layer of bacilli was in direct contact with the air during exposure, in this series of experiments the disks were attached to the cover quartz so that the layer of bacilli bordered on this, with no intervening layer of air. After exposure inoculation in r. Gluteal region of guinea pigs.

6

in r.

30

13

11

18

76 560g.

30/

13

Guinea pig no. 60. Inoculated on 30/3 oi with an unexposed agar disc; so control animal. Weight 895g

Weight 4% 755g, "% 670g, "4/6 650g, 25/8 650g.

Died % 01. Weight 600 g.

Section: Maximum inoculation tub.

Groin hazelnut-sized, non-cheesy glands.

Guinea pig no. 61. Inoculated am/or with unexposed agar disc; so control animal. Weight 765g Weight 28/6 700 g, *% 710 g, "'/650 g,

610 died % 01.

Weight 520g Section: Maximum inoculation tub. Hazelnut-sized glands in r. Strip. Numerous clear, hemp-seed-sized nodules in the lungs.

Guinea pig no. 62. Vaccinated am or with an 'l. Min. exposed agar slice. Weight 735g Died % 01.

Weight 485g Section: In r. Bare bean-sized, strongly caseous glands. Strong vaccine tub. in liver and spleen, fresh nodules in lungs.

Guinea pig no. 63. Inoculated on 30/3 or with an i min lighted agar disc. Weight 675g Died */8 01.

Weight 490g. Section: hemp-seed-sized caseous and emollient glands in r. Strip. In the liver large confluent parts; simultaneous strong shrinkage. Spleen 2 X 1 X '/2 cm, with large caseous portions. Single fresh nodules in the lungs.

Guinea pig no. 64. Inoculated on 01 with a 2 min lighted agar disc. Weight 670g.

Died 26, 01. Weight 10, 600 g.

Section: (Dr. Bie). Strong vaccine tub.

10

30!

9

19

Guinea pig no. 65. Inoculated on 30/3 on with a 3 min lighted agar disc. Weight 650g. Died / 01.

Weight 430g Section: In r. Bar 2 hazelnut-sized, non-cheesy glands. Strongly expanded tub. in the liver and spleen. Fresh nodules in the lungs.

Guinea pig no. 66. Inoculated on o'z oi with a 4 min lighted agar disc. Weight 620g

Died %, 01. Weight 420 g:

Section: In r. Groin glands the size of hazelnuts. Strongly expanded tub. in the liver and spleen. Few clear nodules in lungs.

30/

Guinea pig no. 67. Vaccinated on 30/3 oi with a 5 min.

exposed agar disk, weight 620 g.

Died /

Weight 415g

Section: In r. Groin hazelnut-sized, cheesy glands. Strongly expanded

tubes in liver and spleen, some fresh nodules in lungs.

Guinea pig no. 68. Inoculated on 39/3 oi with a 10 min lighted agar disc. Weight 620g

Died 13%, 01.

Section: In r. Barely hazelnut-sized glands. Strongly expanded tub. in the liver and spleen. Fresh nodules in the lungs.

Guinea pig no. 69. Inoculated at 30% on with a 15 min lighted agar disc. Weight 490g.

Weight 30 or 580 g, 13/6 600 g, 0.720 g, 18/10 730 g, 1795 g, 8/1 740 g, 730 g 720 g, 29/1 730 g. died 19

% 02 of acute pneumonia. no tub in the glands or elsewhere.

Guinea pig no. 70. Inoculated at 30% on with a 15 min lighted agar disc. Weight 575g

Died 31/8 01. Weight 470 g

Section: In r. Barely a hazelnut-sized, hard, difficult to divide, fibrous, dry gland. Liver large with numerous hempseed to pea-sized yellow parts. In the liver numerous hempseed to pea-sized yellow areas and two large islands. Spleen 3 x 2 cm. with numerous confluent islands. In the lungs, numerous milky heaps, ranging in size from miliary to hemp seed.

95!

10

690g,

7

8th

22

13

111

111

6

3

Series VIII (1875 1901). surface culture.

Exposure to unconcentrated arc light in a photucteinometer at a distance of 30 cm, 30 amps, 51 (49-52) volts, at 300 (28 -- 31° C. with a beam angle of 500.

Tubercle bacilli spread on the surface of agar plates as exposed in rows VI and VII. Agar discs of 1 cm diameter are cut out with a tube; the discs are placed in special object glasses with a cylindrical (not spherical) grinding of an appropriate size, so that lateral displacement could not take place; under transport, care was taken to touch the underside only near the edge of the pane. During exposure, the grinding was covered with a 1 mm thick quartz plate. After exposure to light, a smaller disc, centrally located in the discussed agar disc, 1 cm wide, was cut out with a tube of 4 mm diameter, while the former lay untouched in the cylinder-shaped excavation. These small disks were inoculated in guinea pigs in r. gluteal region.

22

9

3

18

16

Guinea pig no. 1 1. Vaccinated on 18/; or with an unexposed agar disc, i.e. control animal. Weight 690g.

Died 29, 01. Weight 630 g (ascites).

Section: In r. Groin larger than hazelnut-sized, whitish, fibrous glands. Maximum tube in the liver and spleen. Significant hemorrhagic ascites. Single fresh nodules in the lungs.

Guinea pig No. 72. Vaccinated on 18/5 oi with an unexposed agar disc, ie control animal. Weight 650g. Died 18/7 on.

Weight 510g Section: In r. Groin hazelnut-sized, cheesy glands. strong tube in liver and spleen, miliary nodules in oment. Hemorrhagic ascites, lungs healthy.

Guinea pig no. 73. Inoculated at the oi with a 10 min lighted agar disk. Weight 650g.

Died 3/12 01 (under an epidemic). Weight 600g

Section: In r. Don't have swollen glands. No tubules in the liver; in a single spot a hemp-seed-sized, white spot of indefinable nature. bronchopneumonia. (Under the relevant epidemic, about 3% of guinea pigs died from bronchopneumonia).

Guinea pig no. 74. Inoculated on 18/5 or with a 15 min lighted agar disc. Weight 620g

Died 3/12 01 (under the epidemic). Weight 620g

Section: bronchopneumonia. no tub

Guinea pig no. 75. Inoculated on 18/5 or with a 15 min lighted agar disc. Weight 620g

Died 190i (under the epidemic). Weight 660g

Section: bronchopneumonia. no tub).

12

18

16

11

20

Guinea pig no. 76. Inoculated am on with a 20 min lighted agar disc. Weight 610g

Died 18/6 oi (cause unknown). Weight 350g

Section: No Tub. normal organs. No glandular tumor in r. Strip.

Guinea pig no. 77. Inoculated on 18/5 on with a 25 min lighted agar disc. Weight 560g

Died 29/1, or (under the epidemic). Weight 540g.

Section: bronchopneumonia. no tub

Guinea pig no. 78. Inoculated at 18% on with a 25 min lighted agar disc. Weight 500g

Died 29/1 0i (under the epidemic). Weight 590g.

Section: bronchopneumonia. no tub

Guinea pig no. 79. Inoculated am or with a 30 min lighted agar disc. Weight 439g Died 19% 01

Weight 410 g Autopsy: No glandular growth in r. Strip. Liver and spleen without tub. Whole r. Lung diffusely infiltrated, hard, firm, whitish, almost cartilaginous. In the uppermost lobe of the first lung numerous miliary nodules up to the size of hemp seeds. (Perhaps inhalational tuberculosis? Tuberculosis as a result of vaccination can probably be ruled out, since neither the glands near the vaccination site nor the abdominal organs show any symptoms of fresh or cured tuberculosis).

11

18

0

Series IX (19% 1902). surface culture.

Exposure to unconcentrated light in photoctetometer at 30 cm distance, 30 amps, 51 (50-53) volts at 30° (30-319) C., at a beam angle of 50°. quartz ceiling.

Tubercle bacilli taken from a glycerine broth culture sown on May 28, 1902, which, as in previous experiments, was made into a thin, slightly cloudy emulsion in 0.6% NaCl-Opl. be rubbed out. From a 1 mm thick sterile agar plate, discs are punched out by means of a tube 4 mm in diameter, which are placed in the unseeded state in the cylindrical recess in the slide (each in its own slide); only then do you seed them on the surface with the emulsion according to JANSENS 1) method using a platinum wire eyelet; each pane is coated with 3 loops of emulsion , which after a few seconds have dried sufficiently, after which the cover quartz

1) See Mitt, from Finsens med. Light Institute III, p. 97.

(1 mm thick) is fixed over the discs. Then exposure in the photocteinometer. After illumination, the agar disc is injected subcutaneously into the back of the r. thighs of guinea pigs.

19

Guinea pig no. 80. Vaccinated on 1986 02 with an unexposed agar disc, ie control animal. Weight 730g

Died 1, 02.

Autopsy: Large caseous glands at the site of inoculation. Maximum tuberculosis in the liver and spleen. Single fresh nodules in the lungs.

Guinea pig no. 81. Vaccinated on 19/6/02 with an unexposed agar disk, ie control animal. Weight 705g

Died 30/8 02.

Autopsy: Large caseous glands near the site of inoculation. Maximum tuberculosis in the liver and spleen. Single fresh nodules in the lungs.

Guinea pig no. 82. Inoculated on 1% 02 with a 3 min lighted agar disc. Weight 620g

Killed 30%, 02.

Autopsy: Large caseous glands near the site of inoculation. In the liver 5-6 tubercles the size of a pinhead; at a single point indication of island formation. The spleen measures 2 x 1 cm, shows 5-6 hemp-seed to cherry-sized, prominent, cheesy islets, which are lobed around cirrhotic. appearance are. lungs free. A cartilaginous gland in the mediastinum. (Diagnosis: severely retarded, probably weakened tuberculosis.)

Guinea pig no. 83. Inoculated on 19/6/02 with a 6 min lighted agar disc. Weight 695g

Killed 30, 02. Very fat.

Autopsy: No sign of tuberculosis anywhere, not even in the vaccinating glands.

Guinea pig no. 84. Inoculated on 1% 02 with a 9 min lighted agar disc. Weight 655g

Killed 30%, 02.

Autopsy: From the site of inoculation upwards to the groin, a number of greatly swollen glands, of which those closest to the site of inoculation are cartilaginous, those more proximal and inguvial are entirely caseous. Liver sound except for a penny-sized portion where there is a cluster of grayish nodules 10-1/2 mm in size, not yet fused. Spleen somewhat enlarged but apparently healthy. Nothing abnormal in the lungs.

Guinea pig no. 85. Inoculated on 19/6/02 with a 12 min lighted agar disc. Weight 650g.

Died 24/6 02.

Autopsy: Parenchymatous changes.

No tuberculosis.

Guinea pig no. 86. Inoculated on 19% 02 with a 15 min lighted agar disc. Weight 620g

Killed "?), 02.

Autopsy: No symptoms of tuberculosis anywhere, not even in the vaccinating glands.

Guinea pig no. 87. Inoculated on 19/6 with a 20 min lighted agar disc.

Killed 307, 02. Sebr fat.

Autopsy: No symptoms of tuberculosis anywhere, not even in the vaccinating glands.

III.

Methods for measuring the bactericidal effect

# of the light.

Of

Valdemar Bie.

it for

measure up.

For a large part of my experiments it was necessary for me to understand the bactericidal action of light

The main difficulty in developing a method for this purpose is that different individuals in a culture have different levels of resistance to the Light. I have had the opportunity to observe this in all experiments of this type that I have carried out; no matter how the experiment was arranged, the bacteria always gradually died out. As an example, I mention the following two experiments where this fact first became clear to me.

attempt no. 1.*7, 1899.

6 Filtration of a six day old broth culture of Bac. prodigiosus through filter paper. Two drops are transferred to 100 cm 3 distilled water. After shaking, application of drops of this mixture to rock crystal plates. As cold water flows over the plate, it is exposed to concentrated light for different lengths of time. Light intensity 18 Amp. 51-49 Volt, 20 cm

Distance from the tip of the positive carbon to the front lens of the concentrator, 1/2 cm diameter of the light cone, 133 mm distance from the center of the outer lens to the back of the rock crystal plate. After exposure, transfer a full loop of droplet to 5 cc agar, which is poured into a Petri dish.

the colonies in the dishes were counted.

Unexposed control culture 918 colonies

Exposure:

I second 266

2 seconds 43

3

9

The experiment was carried out in the same way as the previous one.

The count gave the following result:

Exposure: I second 880 colonies

3 seconds (2nd

15. Drops exposed for 20, 30, 40, 50 and 60 seconds were also sterile.

Against the probative value of these experiments it could be objected that the same amount of liquid is not always caught with an eyelet, and that some of the bacteria may have been completely or partially in the shade as a result of light refraction in irregular places at the edge of the drop; but the assumption seems absurd to me that accidental sources of error such as those mentioned are constantly repeated and should express themselves in a quite regular decrease in the number of bacteria with increasing exposure times, they must necessarily express themselves abruptly in the bactericidal effect. In addition, one sees the individual individuals perishing at different times in the experimental arrangement described later as No. i (see page 52), although the bacteria here lie on a smooth agar surface, where there can be no question of irregular breakage. The last experimental arrangement also refutes a third conceivable objection to the above experiments, namely that the difference in the resistance of the individual individuals could be attributed to the fact that the bacteria on the surface of the drop have easier access to the oxygen in the atmospheric air than the bacteria lying inside the drop. On the other hand, if the bacteria lie on the surface of agar, they all have equal access to oxygen.

PANSINI, BUCHNER and KRUSE, who, like me, counted the remaining bacteria at certain intervals, also found that the bacteria gradually died out. Also BANG's attempts partly gave the same result. He illuminated small drops of bouillon cultures of the Bac. prodigiosus. The drops, which were exposed to light for a short time, grew so luxuriantly that they became diffusely spotted. In those which he exposed so long that they were almost sterilized, one or more well-defined colonies grew out. BANG thereby explains this growth of isolated points. that in every culture there are a few individuals who are more resilient than the majority. My experiments show that there is not a majority with the same power of resistance and a few exceptional cells with greater power of resistance. Within the same culture are a range of different degrees of resilience represented by different individuals.

Had the experiments just described been carried out in the same manner as much of the previous experiment of this kind, viz. by illuminating a recently established bouillon culture and then allowing it to grow out, all one would have learned was that the bouillon was being sterilized, dws that the resistant cells were killed at 12 seconds exposure. But this gives a very wrong view of the resilience of culture, since in no. I about 70% of the bacteria were killed after exposure for just 1 second. The bactericidal effect of light can therefore only be measured by a method which makes it possible to trace the successive deaths of the bacteria by knowing how many individuals are still alive after a number of different periods of exposure. This can only be achieved by counting as in the experiment mentioned above or by using solid culture media.

At the time I began these experiments, Buchner's method of investigating the bactericidal action of light was rightly regarded as the best. It consists of the following: preparation of Koch's plate method cultures in Petric dishes; on

Crosses, letters or the like made of lightproof metal or paper are glued to the bottom of the bowls and the bowls are exposed with the bottom facing the light source. The bacteria lying in the shadow behind the paper act as a control. Due to the difference in the growth density of the exposed and non-exposed part of the culture, the characters written by bacteria and indicated on the glued-on paper stand out strongly. The bacteriologists apparently liked this nice idea of having the bacteria themselves indicate the strength of the effect by means of a kind of photographic representation. In a large part of the treatises that appeared later there are reproductions of Buchner's drawing of a dish in which the bacteria have written the words TYPHUS or CHOLERA. But Buchner's method also has other and greater advantages than these purely external advantages. With this method one achieves that even a slight decrease in the rate of multiplication of the bacteria can be recognized, that the light penetrates into the culture through a glass plate that is at least reasonably flat, that the layer of nutrient substrate through which the light can pass has an approximately constant thickness and that one is secured against the source of error stemming from reduced vitality of the bacteria used, since the exposed and non-exposed parts belong to the same culture. As a result of the use of solid nutrient substrates, Buchner's method also fulfills the requirement I made above that one should be able to follow the sterilization of the culture in all its stages, from a slight decrease in the rate of reproduction of the bacteria to the complete destruction of the most resistant individuals.

FINSEN improved Buchner's method by using, instead of Petri's, bowls formed by enclosing a faceted plate of rock crystal in a brass ring. In this way, more favorable optical conditions are achieved, since rock crystal allows some ultra-violet rays to pass through, which cannot pass through glass and the light only goes through a polished plate that cannot produce irregular refraction, and through a layer of nutrient substrate of almost constant thickness (see page 58). I also used such bowls in the past for my investigations into the ability of light to kill yeast and mold (communication from Finsens med. Lichtinstitut I p. 78).

Three circumstances, however, caused me later to give up Buchner's method altogether, despite these improvements.

1. First, the bacteria lie at different depths in the culture medium. Because of its yellow color - despite repeated attempts I have not been able to produce a usable undyed nutrient substrate, which preferentially absorbs the chemical, i.e. precisely the light rays, to which the bactericidal effect is essentially linked (cf. my treatise: Investigations into the bactericidal effect of the various Departments of the spectrum. Communications from Finsens medical Light Institute 1, p. 40).

The bacteria are therefore hit by light of different strengths, depending on whether they are near the surface or deeper in the nutrient substrate.

2. It must also be borne in mind that, according to a great deal of previous research, the easier the access of oxygen to bacteria, the quicker they are killed by light. For this reason it is unfavorable that they lie partly on the surface of the nutrient medium, where they are in direct contact with the atmospheric air, partly at different depths of the same.

3. Finally I have found that the exposure time necessary to kill the bacteria depends to a large extent on how many bacteria are distributed in the nutrient medium. I have proven this with the following experiments:

attempt no. 3. 3/7 1899.

3

A 9 hour old broth culture of Bac. prodigiosus is filtered through filter paper. With a 1 cm 3 pipette, 150 drops of the filtrate are transferred to 8 cm 3 of agar, and 15 drops to another 8 cm 3; 135 drops of sterile broth are also added to the latter agar to give the two cultures the same color. The agar is distributed in rock crystal dishes 1 cm 3 in each. This is exposed to concentrated light. Luminous intensity: 18 amps, 51-49 volts, 20 cm distance from the center of the tip of the positive carbon to the foremost lens of the concentrator, 1/2 cm diameter of the illuminated spot, 133 mm distance from the center of the outermost lens to the back of the rock crystal plate .

3

a. 150 drops of culture in 8cc agar.

Result: The majority of the bacteria were killed with a 26-28 second exposure.

b) 15 drops of culture + 135 drops of sterile broth in 8 cm 3 agar. After 6 seconds long exposure 8

countless colonies

24

Result: The majority of the bacteria were killed with a 10-20 second exposure

attempt no. 4. 13/1 1899. The procedure was the same as for trial no. 3. 6 hour old culture. i cm 3 broth 48 drops.

a) 200 drops of culture in 8 cm3 agar. After 4 seconds exposure a dense haze

bacteria on the

exposed spot 8

do.

I 2

16

99

After 10 seconds long exposure countless. colonies

do. do. 14

do.

do.

do. do. 18

do.

do. countless. colonies on half of

exposed. spots 26

few colonies Result: The majority of the bacteria were killed with a 22 -- 26 second exposure.

22

3

b. 20 drops of culture in 8 cm | agar.

Due to forgetfulness, 180 drops of broth were not added as usual. After a 1 second exposure a dense veil

bacteria on the

exposed spot 3 seconds

do. do. 5

countless. colonies 7

do.

do. 9

few colonies

do. do. 13

do.

do. 15

do.

do. Result: The majority of the bacteria were killed with a 7-9 second exposure.

attempt no. 5. 1411899.

The procedure was the same as in experiment no. 3.

5 hour old broth. I cm 3 broth 47 drops. Notices a. Finsens Medical Light Institute. vii

1

1 cm 3

a) 200 drops of culture in 8 cm3 agar. Agar contained approximately 5,360,000 bacteria. After 12 seconds long exposure

Result: The majority of the bacteria were killed after 22-26 seconds of exposure.

b) 20 drops of culture + 180 drops of broth in 8 cm3 of agar. 1 cm3 agar contains approx. 536 000 bacteria. After 2 seconds exposure many colonies +

do. do.

do. do.

8th

part colonies

few colonies

do.

do.

6

ok

12

9

20)

do.

do. Result: The majority of the bacteria were killed with a 6-8 second exposure.

The procedure was the same as in Experiment Vo. 3.

1 hour old broth culture.

cm 3

a) 150 drops of culture in 8 cm3 agar. Agar contained approximately 35,000,000 bacteria. After 20 seconds long exposure countless. colonies 24

about 150

do. 28

do.

do. 32

do. 36

do.

do. 40

do.

do. Result: The majority of the bacteria were killed with a 20--24 second exposure.

about 20

99

3

19

ok

b) 15 drops of culture + 135 drops of sterile broth in 8 cm3 of agar. 1 cm of agar contained approximately 3,500,000 bacteria. After 6 seconds long exposure countless. colonies 8

do. do. at least 200

colonies

100 colonies 11

do. do.

do. do. 18

do. do. Result: The majority of the bacteria were killed with 8 -- 10 seconds of exposure.

I 2

approx.

.

16

2

c) 1", drop of culture (3:6 drops of a mixture

3 culture and 3 cm broth) in 8 cm 3 agar + 144 drops of sterile broth.

1 cm' of agar contained about 350,000 bacteria. Approx. 30 colonies after 6 seconds exposure 8

do. do.

do. +

do.

about 5

9

After 14 seconds long exposure

about 4 colonies 16

do. 18

do. Result: The majority of the bacteria were killed with a maximum exposure time of 6 seconds.

about 4

9

From these experiments it was shown that the resistance of a Koch's plate culture depends to a large extent on how many bacteria each cm3 contains. Since nothing can be said with certainty about this in advance, it is impossible to obtain exact results by this method if one is to make a series of experiments extending over a long period of time.

As a result of the three major sources of error mentioned, I have given up using Koch's plate method cultures based on BUCHNER's pattern. Instead, I used that as No. in the following. I described procedure. For special purposes where this method was not applicable, I have also used Methods II and III.

method no. I

Sterile agar is distributed in rock crystal dishes, 1 cm 3 in each; while it coagulates, the dishes are placed on a horizontal plate. The broth culture to be used is filtered through sterile filter paper and, if there is very vigorous growth, diluted with distilled water. A drop of it is transferred to the surface of the agar; by moving the bowl, the drop spreads over as large a part of the surface as possible. The dishes are then placed upside down either in Petri dishes in a thermostat or in a desiccator with calcium chloride. Place the desiccator in the dark. When the thin layer of liquid on the agar surface has evaporated, the cultures are ready for exposure. After this, place the dishes, bottom up, on moist filter paper in a Petri dish so that they themselves act as moist chambers.

When the cultures are fully grown, the exposed part can easily be distinguished from the unexposed part by the weaker growth. The bacteria form a dense veil on the exposed part; a brief exposure causes it to become thinner and more transparent; longer exposures leave only enough bacteria to form isolated colonies; as the exposure time increases, the number of them decreases and eventually disappears entirely.

This method has all the advantages of Buchner's method mentioned on page 45, but none of the disadvantages of the same. All bacteria have equal access to the oxygen in the atmospheric air; the absorption ratios are identical for all, and if one turns the side of the agar on which the bacteria are to the light, no absorption of the same will take place; Finally, the resistance of the culture depends on how densely the bacteria lie on the agar surface . I have verified this through the following experiments:

attempt no. 7th 16th 1900.

/ A two day old broth culture of Vibrio Metchnikoff was filtered. A portion of the filtrate was diluted 1:10 and 1:100 with distilled water. Droplets of this were placed on the agar surface in

ver

Rock crystal shells deposited. These were placed in the desiccator until the liquid had evaporated after 4 hours. Exposure with concentrated light: 18 amps. 51-49 volts, 20 cm. distance from center of carbon tip to foremost lens, 133 mm. distance from rock crystal plate to outermost lens. The light passed through a glass plate placed between the rock crystal plate and the concentrator, 8.5 cm from the outermost lens. I allowed the light to pass through glass in consideration of the ratio mentioned in the footnote on p. 81.

a) Undiluted broth culture. After 2 minutes long exposure

dense growth all over the be

lightened spots 3

do. 4

the bacteria are killed in the center of the exposed spot,

growth on the edge 5

the bacteria are all the way to the brim

killed.

:

b) dilution. i Part broth culture to 9 parts water After 2 minutes long exposure -- All over the be

light. patches of wax

tum 3

culture is poorly matured; there are clear colonies in the light. stains

present

attempt no. 8. 27/10 1900.
The procedure is the same as Experiment No. 5.

a) Undiluted broth culture. After 4 minutes long exposure the bacteria are in

the middle of the belich

dead spots killed 5

do.

do.

7

After 6 minutes long exposure

the bacteria are

all the way to the edge

of the light. stains

out killed

do. do.

do. do. 16

9

7th 8th

99

b) dilution. i part broth culture to 9 parts distilled water. After 4 minutes long exposure on the whole bel.

spots growth 5

do. do. 6

the bacteria are in the middle of the belich

dead spots killed 7

the bacteria are entirely exposed to the brink of. stains

also killed 8

do. do.

c) dilution. 1 part broth culture to 99 parts distilled water. After 4 minutes long exposure on the whole bel.

spots growth

After 8 minutes long exposure

the bacteria are entirely exposed to the brink of. Spots also killed.

Both experiments showed as a result that the time in which a surface culture withstands the light is the same when broth culture diluted with distilled water in the ratio 1:10 and 1:100 than when undiluted broth culture is used. The number of bacteria on the agar surface therefore has no influence on the resistance of the culture.

It is certain that the absorbance ratios will become the same for all bacteria in a dish if you only take care that it is horizontal while the agar is clotting, so that the agar layer becomes the same thickness everywhere. But whether the proportions are the same for a number of dishes depends on the nutrient medium being of the same thickness in all, which one has reason to suppose in advance, since they are all of the same size and are filled with the same amount of nutrient medium. I have verified that this is really the case by taking measurements with the Zeiss instrument for measuring the thickness of cover glasses. I filled 1 cm3 agar in 6 rock crystal dishes. While supporting the back of the rock crystal plate against one screw of the instrument, I screwed in the second so that its tip just touched the surface of the agar, after reading I continued to turn until both points touched the rock crystal plate on either side. The difference between the distance in these two positions gives the thickness of the agar layer. I ascertained by these measurements that the thickness of the agar layer is all the same except a few millimeters from the edge where adhesion to the metal ring is asserted. I measured each bowl in four different places in a circle about 1 cm in diameter around the center.

The results of the measurements were as follows:

Shell No. I 0.26

0.29 0.27

0.30 0.32 0.36 III 0.28

0.30 0.27

0.30mm

II 0.35

0.28

IV 0.32

V 0.28

VI 0.31

0.37

0.30

effekt

got to

0.31 0.35 0.32 It is unavoidable that small movements of the shell will cause some inaccuracy, but nevertheless all measurements are close to the average, which is 0.313 mm. The highest and lowest dimensions are 0.37 and 0.26 mm; they therefore represent a deviation of 0.056 mm above and 0.053 mm below the average.

Of course, when preparing surface cultures, care must be taken that the nutrient substrate does not become so dry that the bacteria do not grow well on it. This danger is avoided by checking on the cultures from time to time and either using them once the liquid on the surface has evaporated or just using them

Take it out of the thermostat and possibly place it on moist filter paper.

When using concentrated light, it is not necessary to use a shader, as only part of the culture is hit by the light cone. On the other hand, when using unconcentrated light, it is necessary to place a shade in front of the culture. This is the case, inter alia, with the use of the method described here, which BANG has staged using a convenient and practical instrument which can be attached to the photocteinometer which he has constructed. Using it, the experiments are not only accurate but can also be performed quickly. The instrument is in releases a. FINSENS med. Light Institute III" p. 102.

For the majority of my experiments, method no. I described here (application of surface culture on solid nutrient substrate) was not suitable for the easily understandable reasons set out below. In addition to this, I used the following methods, which were chosen with regard to the tasks at hand.

Method #II

A surface culture on agar or potato is suspended in distilled water. The solution is filtered through filter paper. Drops of the filtrate are placed on small glass or rock crystal plates. These are placed in Petric dishes and placed in the thermostat until the drops have evaporated. The plates mounted on humid chambers are then exposed. After exposure, the dried bacteria are covered with a drop of agar, the plate is again placed on a humid chamber and placed in the thermostat.

The appearance of the adult culture corresponds exactly to what I have described above as applying to surface culture. No defined colonies are visible on the control glasses and the glasses exposed for a short time, the bacteria form an even whitish veil. Gradually, as the number of bacteria decreases with increasing exposure time, those that are left are given space to grow into isolated colonies which, after a short exposure, are so dense that, almost merging even when very small, but retaining larger spaces after prolonged exposure. These three different stages appear so clearly on the different glasses that there is never any doubt as to which culture belongs. I have named them "merging colonies", "nearly merging colonies" and "dispersed colonies" in my experiment books. If the exposure is continued longer, only very few and finally no colonies remain.

For this procedure, as for the previous one, it is true that the light hits only flat surfaces on its way to the bacteria, that all bacteria have easy access to the oxygen in the atmospheric air, and that one can follow the successive death of the bacteria. The difference from the previous method, namely that the bacteria are attached directly to the plate and not to the culture medium, can be of great advantage in certain investigations. On the other hand, this method, generally used as a normal method, is not as suitable as the previous one, partly because the bacteria are exposed to light in a dried state, which some species cannot tolerate, partly because the resistance of the culture depends on the number of bacteria in the drop , which is dried depends. This can be seen from the following experiments):

attempt no. 9. 1/ 1900. 39% 6 9 p.m. A watery slurry of a 21 hour old unpigmented

1) In a later paper I will discuss a number of other control attempts using this method.

Potato culture of Staphyloc. pyogenes aureus prepared. The slurry was then diluted 1:9 with distilled water. Drops of the diluted and undiluted cultures were deposited on rock crystal plates. I placed these in Petric dishes, which were placed in a cupboard during the night while the drops evaporated. The following day I cemented them to Böttcher's moist chambers with the help of officinal wax ointment and exposed them to Bang's photoctetometer at 20 amps, 51-49 volts, 60 cm from the tip of the positive carbon to the rock crystal plate; the temperature of the water in the photocteinometer was 20°. After exposure, the plates were treated as above.

Result 3/7.

a) Undiluted suspension: unexposed control culture merging coll. after min. long exposure

do.

do. 1 1/2

do.

do. do.

do. 2 1/2

do.

do. 3

do.

do. +

dense, almost

merging col. 5

do.

do. 6

do. (over 100) 8

do.

do. 7

colonies

10

Result: The bacteria were killed after 10 but not after 8 min exposure.

b) dilution.

I part slurry + 9 parts distilled water. Col. 11/2 merging after min. long exposure

do.

do. do.

do. 2"/> ,

do.

do. 3

dense, almost

merging col. 4

2 colonies

2

2

Result: The bacteria were killed at t but not at 3 min exposure.

It therefore has a significant influence on the resistance of the bacteria whether an undiluted suspension or a diluted suspension is used; in the first case the bacteria are killed after 3-7 minutes of exposure, in the last only after 8 minutes. One must therefore be careful when comparing experiments carried out on different cultures; if this is taken into account, completely satisfactory results can be achieved by this method.

method no. Ill. I used this method for the experiments listed on page 41. As mentioned, it consists in that drop

exposed to a suspension of bacteria for different lengths of time; a platinum loop is then dipped into them and the contents processed into Koch's plate method cultures so that the viable bacteria can be counted. A control culture of the unexposed suspension is prepared in the same manner. Counting using this method cannot give completely accurate results, as the amount of liquid absorbed by the eyelet varies too greatly. In comparison with this it is less relevant that not all bacteria have equal access to the oxygen in the atmosphere.

In any case, whichever of these three methods is used, it is necessary to ensure that the bacteria are not damaged during heating. When the culture is exposed to light in Bang's photocteinometer, it assumes the temperature of the surrounding water. During the course of the experiments, for which I used concentrated light, I flowed cold well water through an irrigator tip over the rock crystal plate on which the culture was placed.

One can easily convince oneself that the cooling is sufficient by placing some gelatine in a rock-crystal dish and placing it in front of the concentrating apparatus. Even if the gelatin is not cooled, it takes several minutes before it melts, pouring water over the dish does not melt it, at least not at the light level used in my experiments. The bacteria are not so until

melting point of gelatin heated; the fact that they perish can therefore not be a consequence of warming.

Considering that one can only keep a finger in focus for a very short time, it might seem striking that light should heat a plate culture so little, but the fact is that only the absorbed rays can be converted into heat. While the finger absorbs all rays except a few red ones, the culture media, especially in such thin layers as the one I have used, absorb only part of the chemical rays and almost none of the heat rays (red and yellow).

Using ABSALON LARSEN's actinoscope it can be shown that saline solutions absorb part of the extreme ultraviolet rays, even well water in a very thick layer can absorb them so completely that the actinoscope does not react. I have therefore convinced myself by experiment that a layer of water of so minimal thickness as that which I have employed is meaningless in this respect. It was found that the actinoscope, held behind a rock-crystal slab, responded to the concentrated electric light whether water was flowing over the slab or not.

IV

bactericidal effect of ultraviolet rays.

Of

Valdemar Bie.

In an earlier work (Notifications from Finsen's Medical Light Institute I p. 40) I examined the bactericidal effect of the various sections of the spectrum. I have summarized my results in the following summary:

1. All spectral rays, from red upwards, inhibit the development of bacteria. Whether the red rays are able to kill the bacteria has not been directly proven; all other parts of the spectrum have this ability.

2. The power increases with the exponent of refraction, approximately uniformly, up to the onset of violet; here there is a steeper incline.

3. The effect is therefore mainly due to the violet and ultraviolet rays.

4. These results apply to Bac. prodigiosus and for the light I used (the light of an electric arc lamp of 35 amps and 46-44 volts, collected with the described FINSEN's light collecting apparatus). Notices a. Finsens Medical Light Institute. vii

Earlier, GEISLER, MARSHALL WARD, DIEUDONNÉ and FINSEN had shown that ultraviolet rays are capable of killing bacteria.

FINSEN exposed a Koch plate process culture of Bac. prodigiosus on rock crystal plate with electric light concentrated by rock crystal lenses; in this way he was able to state that the ultraviolet rays possess an extraordinarily strong bactericidal ability.

The other three researchers exposed the spectrum of sunlight and electric arc light to a plate culture and examined whether the effect extended beyond the extreme violet limit.

DIEUDONNÉ also noted a reduction in bactericidal activity when light passed through a 1% solution of quinine sulfate, which absorbs ultraviolet rays.

MARSHALL WARD is the only one who dwells not only on how far into the spectrum the bactericidal effect extended, but also on where on the spectrum it was most powerful. It began in the "green" about the transition to blue, was strongest in the "blue" about the transition to violet, and decreased in the "violet". The effect of electric light, which contains many ultraviolet rays, extended far into the region of these rays in the application of rock-crystal prisms, and the passage of the light through glass blocked a great part of these effective rays.

As to the detection of the point of maximum effect, MARSHALL WARDS experiments are not entirely reliable.

It is certainly only a very insignificant defect that he did not measure how long each individual spectral segment had to act on the bacteria before they were killed; however, by comparing a series of experiments with different exposure times, it is possible to see with some certainty where the effect is strongest. An objection of far greater importance is that MARSHALL WARD used Koch's plate method cultures in agar; on its way to the bacteria, the light passed through a thicker or thinner layer of matter, which mainly absorbs the blue, violet, and ultra-violet rays. With this arrangement of the experiments, therefore, it cannot be avoided that the point of maximum effect is shifted towards the green part of the spectrum.

In my earlier experiments I used concentrated electric light from a 35 amp arc lamp; before striking the cultures, it passed five thick glass lenses; it was thus deprived of all extreme ultra-violet rays which could not pass through glass, and certainly part of the other near violet rays. The culture was a Koch's plate method culture in a 1.-2 mm thick agar layer. The same applies to this experiment as I objected to that of MARSHALL WARD: it gives too low values for the chemical rays, owing to their absorption in the lenses and in the agar. Nevertheless, I found that when I passed the concentrated light through a 3 cm layer of 1 per cent. quinine sulphate solution, its bactericidal action was reduced to 1/1 of its value when the light passed through distilled water alone. Thus, ignoring that the quinine sulfate solution absorbs a small number of violet and blue rays, the result of the experiment was that when the effect

j*

of the whole visible spectrum is set to i, only that part of the ultraviolet rays which can pass through the glass dws rays of 350-300 nm wavelength has an effect of 2.

Since these experiments I have made, the ultraviolet rays have come to play a major role in phototherapeutic practice. However, it has not yet been determined how strong their bactericidal effect is. It therefore seems interesting to me to investigate this further.

The method used by the three investigators mentioned earlier, of projecting a spectrum onto a culture, is not so useful for "measuring" the action of ultraviolet rays as for showing how far the bactericidal action extends over their area. For it is difficult to decide with certainty where on the culture a particular section of the spectrum has fallen, and one has no other means than color sense to distinguish the various sections. At the same time, the boundaries between the individual sections of the spectrum are entirely indefinite, especially those between the extreme violet and ultraviolet rays, that is, precisely that which is important in this case. I have therefore preferred to use absorption ratios, determined by the most exact physical methods of investigation, as the basis for measuring the bactericidal power of ultraviolet rays. Carrying out the experiments in this way, one knows with certainty what rays the light contains in each individual case, and is not dependent on any subjective judgement.

Before the light hit the cultures, I let it pass through either glass or rock crystal. I'm the

In order to determine the absorption of ultraviolet rays in relation to these two substances, I photographed the spectrum of arc light; this was collected into parallel rays by means of a rock-crystal lens and passed through either a rock-crystal or glass plate before passing through the slits of the spectrophotographic apparatus. The spectrum was displayed using a Rowland grating and projected onto silver bromide paper.

The light, which had only passed through rock crystal, resulted in a spectrum whose blackening was evenly distorted from paper up to a wavelength of 200 ml. According to MÜLLER- POUILLET 's Handbook of Physics, STOKES also found that rock crystal is impassable for rays with a wave width of up to 200. Since rock crystal is a specific chemical, I assume the limit is here.

The photograph of the light which had passed through the glass plate shows a very sharp limit for the blackening, corresponding to the rays of 295 µu wavelength. Since it is generally stated that the absorption limit for glass is at 350---300 uu wavelength, the type of glass I use allows a relatively large number of ultraviolet rays to pass through.

The difference in the bactericidal action of the light which has passed through rock-crystal and that which had passed through glass, is thus an expression of the action of rays whose wavelength lies between 200 and 29 5 microns.

Strictly speaking, it is not correct that I vindicate the term "ultraviolet rays" only to this part of the spectrum; because the limit for the visible spectrum is, according to WIDMARK's investigations, approximately at a wavelength of 385 jaje; the rays whose wavelength lies between 385 uu and 295 mu are also ultraviolet; but in phototherapy it is not the influence of the human eye, but precisely the absorption ratios of the glass and the rock crystal that form the boundary.

The rock crystal plates I used are 22 x 22 mm in size and 0.5-1 mm thick; it does not matter that their thicknesses differ, as they do not absorb the rays whose effect I am about to study. On the other hand, it was necessary that the glass plates were all of the same thickness, since the quantity of rays not absorbed decreases in geometric progression as the thickness of the absorbing material increases in arithmetic progression. I chose a thickness of i mm. They are made by Zeiss in Jena and worked very precisely; 10 randomly chosen plates mass resp. 0.99 -- 1.101 - 0.97 - 0.98 - 0.97 - 0.98 - 1.102 - 0.96 - 1.1001.104 mm. Their size is like that of the rock crystal plates. They are made of flint glass, the type of glass that allows the most ultraviolet rays to pass through. I have chosen this type of glass because it seems to me that it is of the greatest interest to find the minimum value for the difference between rock crystal and glass.

As I have indicated above, the first condition for measuring the bactericidal effect of ultraviolet rays is that no light is absorbed on its way to the bacteria. In order to meet this condition as far as possible - to be quite sure, one would have to be able to arrange for the bacteria to lie in a single layer on the flat plate

I have the experimental setup no. II (see p. 59) which consists in a drop of the watery Auf

floating of bacteria on rock crystal or glass plates is applied. I mounted the plates on BÖTTCHER's humid chambers and exposed them in the photocteinometer at 25 amps, 51-49 volts; the temperature of the water in the photocteinometer was 20°; the distance from the culture to the center of the positive charcoal tip was 30 cm. After exposure, the dried bacteria were covered with a drop of agar and the plates returned to the humid chambers placed in the thermostat.

For all experiments I have unpigmented potato cultures of Staphyl. pyog. aur. used.

415 1901.

8th

attempt no. 1.

The plates were prepared on 3/5 at 10'' pm and placed in the thermostat at 339 during the night.

Cultures were examined on 8/5.

exposure through glass.

After 5 minutes of exposure, numerous, densely

colonies

do.

do.

() colonies

20

9

30

I made no experiment with rock crystal that day.

Result: The bacteria were killed by exposure through glass for 10--20 minutes.

5

attempt no. September 2, 1901.

The drops are dried by standing in the thermostat at 379 for five hours.

Illuminated cultures were examined on 5/11. a) Exposure through glass. control culture

almost merging colonies After + min. exposure do.

do.

do. 6

do.

do.

do. 8th

do.

do.

do.

do.

do.

do. 8 colonies

99

10

.

I 2

:

b) exposure through rock crystal.

In the control culture, the colonies were fused. In the cultures which were exposed to light for 2, 4, 6, 8, 10, 12, 14, 16, 19, 22, 25 and 30 seconds, isolated colonies were found which were partly merging and partly close together.

Result: Bacteria were killed by 10---12 min exposure through glass plate, but resisted 30 sec exposure through rock crystal plate.

attempt no. 3. 13; 1901

The drops were dried by standing in a Perri's dish in a cupboard overnight.

Cultures were examined on the 15th.

a) Exposure through glass. control culture

merging colonies After 4 min. exposure densely packed, innumerable colonies 6

do. do.

do. do. 8th.

do.
do.

do. do. do. do.

do. do.

ok

ok

b) exposure through rock crystal. Vach

5

sec exposure merging colonies

nearly merging colonies 15

do. do.

do. do. do.

do. 30

do. do.

do. 40

do. do.

do. 50

do. do.

do. Nlin.

colonies

20

.

1

about 75

1 1/2

3 Result: The bacteria were killed by exposure to glass for about 12 minutes and exposure to rock crystal for about 5 minutes.

attempt no. 4. 16/ 1901.

The plates were prepared on 15/5 at 10' pm in the afternoon; the drops were dried in a thermostat at 34° by standing overnight.

Cultures were examined on 18/5.

a) Exposure through glass. control culture

merging colonies after 4 min exposure

do.

do. 6

do.

do. 8th

densely standing innumerable col. do. do.

do. do. do. do.

do. do.

I 2

10

99

99

20

b) exposure through rock crystal. control culture merging colonies After

5

sec exposure

do.

do. do.

do,

15

almost merging colonies

do

do.

do. 30

do).

do.

do. Jicht standing, countless col

12 colonies

minutes

5/4 ,

1/2 ,

10

9

:

50

I

10

1 2

:

I

:

Result: The bacteria were

Killed in 12-14 min exposure through glass and 40-50 sec exposure through rock crystal.

The main result of the experiments is that the bacteria are killed when exposed to rock crystal for about 1 minute, but only when exposed to glass for about 12 minutes.

If one sets the value 1 for the bactericidal effect of the rays which had passed through the glass, the rays which the rock crystal lets through receive a value of approx. The resulting difference is an expression of the effect of a part of the ultraviolet rays, which have a wavelength that is between 200 uu and 295 uu and which only through

I 2.

Rock crystal, but unable to penetrate glass. So these rays have about 10-20 times the effect

-like all the rest of the spectrum, which is within a wavelength of 295 up and about 760 ug, where the spectrum of light I used ends at the ultra-red to red transition.

However, the numerical values I have given here only apply to the experimental arrangement used in this case, since the amount of ultraviolet rays in electric light is very variable. Of particular note is Absalon Larsen's demonstration that the violet and ultraviolet ends of the spectrum of arc light increase in intensity far more rapidly than the red as the amperage in the lamp concerned increases, and that for the same current density) the light from a large lamp is proportionately somewhat more intense developed in the violet part than that of a small lamp. So the amount of ultraviolet rays depends on the amperage and the lamp; it goes without saying that it also depends on the chemical composition of the coal. Consequently, no general rule can be given as to the relation between the action of the ultraviolet rays and the rest of the spectrum. The result to which I have arrived with my experiments is therefore only valid for the specific experimental arrangement which I have used; if the chemical composition of the carbon or the amperage of the lamp is changed, or if a larger or smaller lamp is used with the same amperage, the ratio will change somewhat.

1) D. ws The relationship between the diameter of the positive carbon and the amperage.

Under all circumstances one can conclude from my experiments that the rays which are able to penetrate only through rock crystal but not through glass, i.e. those whose wavelength is between 200 uu and 295 uu, have possessed an extraordinarily powerful bactericidal effect in the light which I used, whether this is due to the fact that these rays in themselves possess this property in a high degree, or that the light I used in these experiments was more intense in this part of the spectrum than in the others.

As far as sunlight is concerned, I refer to an experiment which FINSEN reported in Finsens med. Lichtinstitut III, p. 7 described. He found that sunlight concentrated with mountain crystal lenses Bac. prodigiosus as much with a 4 min exposure as with a 5 min exposure when it had also passed through a glass plate. The reason that the ability of sunlight to kill bacteria was not more diminished by its passage through glass is that the extreme ultra-violet rays which are absorbed by glass are also absorbed by the atmosphere. Sunlight, therefore, contains very few rays of this kind.

Résumé: 1. Under the circumstances under which my experiments were carried out, the effect of the ultraviolet rays, which have a cell width between 200 uu and 295 uu, is about 10-12 times greater than the effect of the whole remaining spectrum from the beginning of the red (about 760 uuj to the beginning of the discussed section of the spectrum (295 uu).

2. This ratio only applies to the experimental arrangement described, since the amount of ultraviolet rays in electric light varies, depending on the chemical composition of the coals, the current strength and the diameter of the coals, among other things, so that there is no valid value for all cases Il'effect of ultraviolet rays can fix.

V

The habituation of bacteria to exposure

Of

Valdemar Bie.

Because of the pronounced ability of bacteria to adapt to new living conditions, one might assume that if a culture is exposed to light for a long time or several times, it can become accustomed to the originally harmful agent, so that its resistance becomes greater than that a corresponding culture which has not been exposed to the light. It would be of practical interest in the light treatment of infectious skin diseases if the resistance of the microbes in question were increased by constant exposure of the diseased parts of the skin to daylight. The healing of the disease would be made more difficult, and to avoid this and to make disappear any increase in resistance that might already have occurred, it would be advantageous to cover the diseased parts with a lightproof cloth from the beginning of the treatment. Prof. FINSEN made use of this measure when he treated one of his first lupus patients; between the individual treatment séances he covered the affected area of the skin with a red plaster.

If my experiments showed that the resistance of the bacteria was increased not only by exposing them to daylight, but also by one or more exposures to concentrated light without being killed, it would follow that each to prolong a single treatment séance in such a way that one would be sure to have destroyed all the microbes that were in the treated part of the skin.

The purpose of my first series of experiments was to decide whether the bacteria could achieve increased resistance to a stronger light (concentrated electric light) by prolonged exposure to a weaker light (diffuse daylight).

I have grown two sets of bouillon cultures from Vibrio Metchnikoff, one in ordinary daylight, the other in the dark, but otherwise under identical conditions; after 3-5 months I checked whether the light culture had acquired greater resilience than the dark culture.

In order to reduce the absorption in the broth as much as possible, I used small test tubes with a diameter of 13-14 mm with 2 cm3 of culture in veal broth. They were mounted in a glass door thermostat; one test tube was exposed to daylight, the other stood in a tin cylinder with a light-tight lid. In order to allow some time before the bacteria clouded the broth and thereby weakened the depth of the light, I kept the temperature of the thermostat at 26-28o. In order to gradually accustom the bacteria to the light , I put the thermostat in the darkest, innermost corner of the room for the first week; later he stood up

a south-facing window, the panes of which were painted white so that the bacteria were never struck by direct sunlight but were constantly exposed to diffuse daylight.

Given that the test tubes were in the thermostat, it is certain that the broth was the same temperature in both cases. In order to be still more certain, I repeatedly measured the temperature in two test-tubes with water, which were kept under the same conditions as the broth cultures; I have never found more than 2° difference. The experiments began on 11/ 1900.

As a rule I inoculated into fresh broth every day; in the period from 5/7% the cultures (10 cm) were still standing without inoculation into fresh broth, and from 1975-3, inoculation was carried out only once, namely on 27/8. The inoculation of the dark culture was constantly carried out in the darkroom, so that during this period it was exposed only to spectroscopically pure red light and the light of a spirit lamp.

To investigate whether the light culture had acquired a greater power of resistance than the dark culture, I used the method described on page 52 (Method No. 1, use of surface culture). Preparation of dark culture plates was performed in the darkroom under the light of an electric incandescent lamp. The desiccator with these dishes stayed in the darkroom, the one with the light cultures in the laboratory in diffuse daylight.

The cultures were exposed to the light of an 18 amp, 51-49 volt electric arc lamp concentrated through a FINSEN concentrator with rock crystal lenses. The foremost lens had been removed;

the apparatus was consequently adjusted in such a way that the distance between the center of the tip of the positive carbon and the uppermost lens became equal to the focal length of the latter (20 cm).

The rock crystal shells were mounted on a tripod perpendicular to the axis of the light cone. The distance between the rock-crystal plate and the outermost lens of the concentrator was 133 mm;

; as this point is out of focus, there is a circle of ultraviolet rays at the periphery of the cone of light, the presence of which can be seen by their effect on the cultures, the spot on which the bacteria are killed having a diameter of 17 mm.; this is 2 mm more than the visible part of the light cone. To protect myself against the bacteria being heated by the light, I allowed a stream of cold water to flow over the rock-crystal plate for the duration of the experiments.

Since the bacteria, by being exposed to sunlight, could of course only get used to the effects of the rays that are found in it, the light with which one tests their power of resistance should contain only the same rays as far as possible. To achieve this, I let the concentrated light pass through a 1.2 thick glass plate 1) which is placed between the

at least

1) The passage of light through a glass plate contributes greatly to obtaining consistent results. In my numerous experiments I have constantly observed that when a culture is exposed to electric light containing these extreme ultraviolet rays, the power of which is more variable, varying from experiment to experiment, and the successive perishing of the individual individuals being more evident than when this Light is deprived of these rays by passing through glass. In such a case one sees that after an exposure, which messages a. Finsens Medical Light Institute. vii

concentration devices and the rock crystal bowl, 50 mm from this. Since both glass and atmospheric air absorb ultraviolet rays below 300pp wavelength, this arrangement causes electric light to contain mainly the same qualities of rays as sunlight, albeit in slightly different proportions. The superiority of electric light over chemical rays was further reduced by passage through the agar layer. Sunlight cannot be used for such quantitative investigations because it is not constant.

After exposure, the dishes were placed, as usual, upside down on moist filter paper in Petri dishes and then placed in the thermostat.

is only slightly shorter than that required to kill all the bacteria, and numerous living individuals can still be found distributed over the entire exposed spot. This never happens when the light contains many ultraviolet rays; in such a case the relation becomes such as I have demonstrated in the experiments on p. 41; the bacteria gradually perish, and long after the majority of the bacteria have been killed there are still single living individuals, which only very slowly decrease in number.

This difference between ultraviolet-rich and ultraviolet-poor light is certainly not based solely on the fact that the development of ultraviolet rays from the lamp varies more than the development of the other types of radiation. The main cause is certainly to be found in the fact that the slightest hindrance to the passage of light, e.g. B. a slight turbidity or a number of bacteria lying one behind the other, mainly affects the ultraviolet rays. I have the feeling that even the rapid course of the experiment leads to irregularities analogous to the experience with photographic negatives, which have to be developed slowly if you want to have all the details emphasized; I imagine that similarly the plate cultures need to be influenced for a while before they are worked through.

The results of the experiments are evident from the following schemes, where, in order to make the survey easier, I have indicated the degree of action in a special column by means of numbers which designate certain stages in the successive destruction of the bacteria.

I

o means that there is a dense patch on the exposed spot

Veil of bacteria located in which none

individual colonies can be distinguished.

that appear anywhere on the exposed spots

find isolated colonies.

that there are isolated colonies in

smallest number in the middle of the exposed

Stains. 3

that the bacteria in the center of the exposed spot are killed, while at the edge one

5 mm wide band of colonies is noticeable. +

that located at the edge of the exposed spots

-5 mm wide belt of colonies in front

finds. 5

that appear at the edge of the exposed spot

mm wide belt of colonies. 6

that appear at the edge of the exposed spot mm wide belt of colonies. 7

that the bacteria are completely killed up to the edge of the exposed spot.

a 2

2

I

So the numbers don't have the same meaning as their numbers are worth; if a culture For example, if one belongs to group 6 and another to group 3, this does not mean that the effect in the first case was twice as powerful as in the last.

attempt no. 1. Performed 29th, 1900 with broth cultures dated 18/g. Result on 24/, read.

20

9

attempt no. 2. Executed on 25), with the cultures of 99/g. Result on 29), read.

22

9

The result of these two trials was that the light culture had a slightly greater resilience than the dark culture, or in other words, that a lesser degree of "habituation" had taken place.

attempt no. 3 Carried out on */10 with broth cultures from the 10th result on 640, read.

61

10

I will make a few remarks later (p. 88) on the result of this experiment.

The three experiments discussed so far have been carried out with cultures from which generation after generation has been grown for 3-5 months in light resp. had stood in the dark. I let them stand that long before testing their resilience, partly by accident, partly because I assumed that any change in resilience would have to propagate from generation to generation. To the

attempt no. 4. 1/10 3 broth cultures created: 1) from the culture which had been in the dark since the "/&. The same was placed in the dark. (dark culture) do. do. do.

do. Light set (new light culture) 3) do.

light (ancient light culturey) the resistance of these three cultures was tested in the manner described earlier. The result was published on

2)

13

110

3

I

3

1

3

К о nien on the whole exposed patch; everywhere the same

Colonies all over the exposed spot; everywhere the same

do. in the light

16/10 read.

do.

exposure

in minutes

No. 1.

dark culture

effect

degree exposure in min.

No. 2.

New light culture.
Had been in the light for 2 days

effect

degree exposure in min.

No. 3

Old light culture

effect

Degree

Colonies all over the exposed patches

the same number of

attempt no. 5.

2

11

Broth cultures similar to those used in previous experiments were established on the lue. Their resistance was tested on /u. This time culture no. 2 so only one day in the light. The result was read on the 5'u.

11

3

2

3

3

Colonies anywhere on the exposed spot, least in the middle

Colonies all over the exposed spots; all over

the same number of

colonies all over the be. lightened spots; the same everywhere

many

2

4

2

4

2

No. 2.

exposure

in minutes

No. 1.

dark culture.

effect

degree exposure in min.

New light culture.
Had a day in the light

confessed

effect

degree exposure in min.

No. 3. Ancient light culture

effect

Degree

Colonies throughout exposed patch; very few in

the middle

Colonies throughout exposed patch; few

in the middle

Colonies throughout exposed patch; at least

in the middle

In the two next experiments I used partly two cultures, which corresponded to the two which I used in the previous experiments, partly a culture which came from the dark culture but had stood in the light for a day or two. Of course, all three cultures were created at the same time.

In all trials except No. 3, which I discuss later, the light cultures possessed a somewhat greater resilience than the dark cultures; the various levels of bactericidal action emerged an average of one minute later (the numbers in the relevant headings are lower). This difference is about the same whether the cultures come to light a day or two, or generation after generation

4

-Had been suspended for 5 months. Thus, exposure of a culture to diffuse daylight for 3-5 months gives it a slightly enhanced resistance to concentrated electric light, which contains about the same qualities of radiation as sunlight, albeit in somewhat different proportions. This habit, however, is too slight to be given the practical importance mentioned earlier.

attempt no. 3 gave a different result than the others; on that day the light culture perished faster than the dark culture, and faster than any culture in the other experiments. It is hardly to be assumed that the underlying cause here can be traced back to an experimental error, since the resistance of both the light culture and the darkness

9

culture remained approximately unchanged throughout all four other trials, and also the ratio between their resistivity was approximately the same.

On the other hand, the explanation that seems to me to be probably the correct one is that the vitality of the light culture was weakened that day, possibly because the sun was shining unusually strongly on the 10, when the culture was started, and again on/10, there the test was performed while the period between the 25 since the previous test was performed and the %10 was extremely poor in sunlight. As a result of friendly information from the Meteorological Institute, in September 1900 we had an average of 220 minutes of sunshine per day; the observation is made with a soautograph; in the periods from 25--1/10, both days included, we had an average of only 61 minutes of sunshine per day; on the 1/10 the sun didn't shine at all, on the 21st 440 minutes, on the 3.0 not at all, on the 4/10 450 minutes. On the day the culture was inoculated, 2/10, it was thus exposed to a light to which the bacteria had not been at all accustomed in the preceding period, and the same was on the 1/10 from early morning to mid-afternoon, when the Trial started the case. This may have reduced the vitality of the bacteria. That this may be the result of a short, intense exposure is evident from a few later experiments (Nos. 7 and 8, pp. 94-95).

This explanation can of course only be considered as a hypothesis. If correct, this experiment supports my assertion that the bacteria can only in a small degree accustom themselves to light. Had standing in light for almost four months

from

the cultures did not attain such a great extension of resistance that they could endure a few days of strong sunshine after a dark period.

In the experiments hitherto described, there was a significant difference in intensity between the light in which the cultures stood and that with which their power of resistance was tested. The discrepancy was exacerbated by the fact that the broth protected part of the bacteria from the chemical rays. This difference in intensity is a source of error which must be taken into account before it is accepted that the habituation of bacteria to light is as low as these experiments show. The reason I nevertheless chose the procedure described to me was that I wanted to investigate whether treatment with concentrated light would be counteracted by exposing the diseased area to sunlight. For this purpose, by the nature of things, only sunlight can be used, and preferably even sunlight weakened by passage through a substance which absorbs part of the chemical rays, and concentrated electric light to measure the degree of habituation.

In order to decide in principle whether the bacteria acquire increased resistance as a result of repeated exposure to several successive generations, I made another experiment in which I avoided the source of error just mentioned, both in order to induce possible habituation and to increase its degree measure electric light used. I exposed drops of a bouillon culture of Vibrio Metchnikoff in several successive generations with concentrated electric light, which had only passed through rock crystal. I began with such a short exposure time that the bacteria were scarcely injuriously affected by it; the next day I transferred a quantity of the exposed drop, in which the bacteria had meanwhile fully grown, to a sterile drop of bouillon and exposed it somewhat longer. In this way I proceeded daily with inoculation into sterile broth and exposure to it at steady but slowly increasing times, until such time as is necessary to sterilize the drops if habituation has not taken place. From a number of previous attempts I knew that the time required for this was about 1-1 min. - The current D

/2 was 18 amps, the distance from the tip of the charcoal to the nearest lens was 20 cm.

In the same way I grew a number of control cultures, transferring a quantity of a drop culture to a drop of sterile broth daily.

To measure the resistance of the bacteria, I used method no. 1 served (drying on agar surface).

The attempt was as follows:

attempt no. 6.

The culture used was a dark culture from experiments no. 1

5.

A number of successive generations of this culture were exposed for 10, 15, 20, 30, 40, 50 and 60 seconds from 21/11 7/11. On November 28th, the day after the 60-second exposure, I inoculated in 2 cm3 of broth in the morning; in the evening I prepared surface cultures from this, which stood in the darkroom during the night

and were exposed the next morning. The cultures were prepared and exposed in the same way as in experiments no. I 5 in front of you. The cultures were examined on 3/12 with the following results:

3

a. light culture.

approx.

mm

no effect:

do. the bacteria are in the middle of the exposed area on a 3rd

Killed diameter large spots. along the edge of the exposed spot there is a 2-5 mm wide border of colonies. along the edge of the exposed spot there is a 2-3 mm wide border of colonies. the bacteria are all the way to the edge of the exposed spot

After 4 min exposure the bacteria are quite up to

edge of the exposed spot

killed. 5

do. 6

do. 7

do. 8th

do. Result: The effect on all light cultures was slightly less than on the corresponding dark cultures. All bacteria perished in the dark culture after 4 minutes of continuous exposure, but in the light culture only after 6 minutes of continuous exposure.

Two days after the last exposure, there was a clear difference in the hardiness of the two cultures. It may have been a coincidence; it is so difficult to make perfectly accurate measurements of the resistance of bacteria to the light, that in an experiment showing so little difference as here one must be careful in drawing conclusions. Therefore, if I had only to stick to this attempt, I should not conclude that gradually increasing exposure resulted in habituation. But this conclusion seems to me to have greater justification when I consider that this experiment gave the same result as that (No. 1 ---5) using daylight.

The habituation produced is meanwhile only slight, just as slight as that caused by sunlight.

In the experiments I have undertaken up to now I have investigated whether the power of resistance of a series of cultures to the light changes over a long period of time prolonged standing in moderately intense light, or prolonged, gradually increasing exposure. In subsequent experiments I investigated whether the resistance is changed by exposing the bacteria to a single strong light.

attempt no. 7.

The tests no. 1-5 belonging dark

1 culture was used to prepare agar surface culture in the manner described on page 52. One of the cul. tures remained in the dark, the rest were exposed for 3, 4, 5, 6 and 7 minutes. In the dish which was exposed to light for 4 min, the bacteria were killed in the center of the exposed spot and isolated colonies grew at the edge of the same. From one of these, which was nearest to the sterile spot, I inoculated into broth, also from the dark culture. From these two broth cultures I again prepared agar surface cultures in rock crystal dishes. These were made in the same manner as in experiments no. 1 -5 exposed (the light fell through a glass plate). The result was the following:

a. Broth culture derived from the control dish. After 3 min exposure -- Colonies almost merging

on the

whole exposed

Stains.

5 ,

along the edge of the exposed

Stains found a 1/2 cm

wide embellishment of colonies,

ñ ,

the bacteria are quite up to

edge of the exposed spot

killed.

Of

b. Broth culture derived from a colony of the + min. lighted dish. After 3 min exposure on the whole exposed spot

dense almost merging

colonies. +

there was a 1/2 cm along the edge of the exposed patch

wide border of colonies. 5

the bacteria are all the way to the edge of the exposed spot

Result: With a 4-minute long exposure of the

. Culture obtained from a 4th generation colony

minute exposure of the dish, the same effect was obtained as when the control culture was exposed for 5 minutes.

attempt no. 8th.

Immediately after Vibrio Metchuikoff had prepared a broth culture, drops of it were deposited on rock-crystal plates and exposed to concentrated electric light for varying periods of time. The following day growth was observed in the 1/4, 1/2 and 3/4 minute exposed drops whereas there was no growth in the 1", and 2 minute exposed drops. From a 3/4 minute exposed drop, as well as from one Drop which was not exposed was inoculated into broth the next day as these broth cultures were fully grown

, were, I used them to prepare agar surface culture, which I exposed to light in the apparatus (page 59) and photocteinometer constructed by BANG. The light level was 22 amps, 51-- 49 volts, 2 feet from

the positive electrode to the culture. The temperature of the water in the photocteinometer was 25°

When the cultures were fully grown, they had the following appearance:

a. Culture derived from the drop exposed for 3 minutes. Colonies merging after i min exposure,

nearly merging colonies, 3

do.

do. 5

dense colonies, 7

only a few colonies

do. 2 colonies.

2

9

9

12

I 2

5

do. 7

nearly merging colonies, 9

do.

only a few colonies, 15

do. Result: 5-7 minutes exposure of the culture originating from the exposed drop produced the same effect as 9-12 minutes exposure of the control culture.

Both experiments thus gave the result that if a culture of Vibrio Metchnikoff is exposed to a single strong exposure, the first culture derived from it acquires reduced resistance.

I couldn't see any change in the vitality of the Stafyloc. pyogaur. and Bac.-coli communis if I apply them to the experiment no. 8 described manner treated. I don't know what this difference is based on; but presumably it is related to the greater resistance of these two species to external agents

Résumé: 1) By placing a number of successive generations of Vibrio Metchnikoff broth culture in diffuse daylight, the bacteria obtained a very slight increase in their resistance to concentrated light, which had approximately the same composition as sunlight, by producing a 1,2 mm thick piece of glass and an approx. 0.3 mm thick agar layer. The culture which was in daylight was compared with the culture which had been in the dark for 3-5 months but otherwise under the same conditions as the light culture; they were usually both inoculated daily into fresh broth. The increase in resistance was approximately uniform whether the culture had been exposed to light for 1-2 days or 3-5 months.

2. A similar low degree of habituation was obtained by exposing a number of generations of Vibrio Metchnikoff's broth cultures to concentrated electric light daily for a time which increased from 10-60 seconds.

3. A broth culture derived from a culture of I'ibrio Metchnikoff, which, immediately after inoculation, was exposed to concentrated electric light for so long as to almost kill the bacteria, had reduced il'idresistance

.

VI.

Studies on the effect of light on infusoria.

Of

Georges Dreyer.

Earlier investigators who have dealt with the question of the action of light on infusoria have either turned their attention to the importance of light for reproduction or, like ENGELMANN 1) have made investigations into the remarkable ability of these organisms to distinguish between different spectral colors within certain limits to be able to distinguish.

The detailed analysis of the ability of the various qualities of light to kill the infusoria, and of the manner in which the infusoria die-off takes place, has not, as far as I know, been the subject of careful study. The following explanations, which are based on a series of exact observations, should bring clarity to these relationships.

Various species of infusoria of unequal size were used in the experiments; some of these are well known, while others are not.

For the sake of clarity I have arranged these ui species of infusoria into 3 groups according to their size.

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1 Engelmann, Th. W., "On light and color perception of the lowest organisms". Archive for the entire Physiol. Vol. XXIX, 1882.

from

Group 1 includes 3 species of infusoria, L, F and B, of these, L is a species of Dysteria, while F and B are two small infusoria, of which F is approximately from

,

F same size as L (Dysteria), while B is slightly larger and significantly smaller than glaucoma scintillans. The 3 infusoria belonging to this group are called small. Group 2 includes 5 species of infusoria, K, H, C, G and

which is not a Nassula species, while the others are unspecified but of about the same size as K (Nassula).

The infusoria belonging to this group are called medium-sized.

Group 3 includes 3 species of infusoria, I, E and A, of which I is a species of Stylonychia, while E and A are two infusoria of the size of that species. The infusoria of this group are called large.

The infusoria are obtained by placing various plant infuses. Pure breeding was done by overseeding in hay infusion in cases where there was a mixture of several forms.

The experimental setup was as follows:

As a light source I used an electric carbon-arc lamp, and the light was concentrated by a FINSEN concentrator with rock-crystal lenses; the diameter of the positive resp. negative coal was 2.4 resp. 1.5 The lamp burned at 30 amps and cm.

49 - 50 volts.

The distance from the top of the positive carbon to the nearest lens in the concentrator was 11.5 cm. The rock-crystal shell used to illuminate the infusoria is described in more detail in an earlier treatise!).

I) Dreyer, G.: "The effect of light on amoebas". Communication from Finsens med. Lysinstitut IV 1903, page 81.

and pictured. They were placed in the cone of light below the focal point, where its diameter was 1.2 cm and constantly perpendicular to the direction of the beam.

The infusoria culture intended for exposure was placed as a hanging drop centrally on the inside of the rock crystal lid, after which, in order to enable uninhibited microscopy of the exposed drop, the bottom of the lower shell was first covered with a 2 mm layer of distilled water to prevent drying and condensation .

The size of the drop was in all cases as equal as possible, about 0.5 mm at its greatest thickness, and the number of infusoria in each drop was usually about 30-40.

Water was sprinkled over the dishes during the exposure, which eliminated the heat effect.

The exposure is made in such a way that partly the whole visible spectrum plus ultra-violet rays are allowed to act, viz. exposure through rock crystal alone, partly in such a way that the different parts of the visible spectrum are completely or partially eliminated.

The switching off was done by placing an absorbing medium in the light cone between the dishes and the concentrating apparatus.

As absorbing media clear glass was used, which, as shown by spectroscopy, allowed the whole visible spectrum to pass), blue glass, which allowed blue, violet and part of the yellow, green, and red rays to pass, and 5% monochromic acid Potassium, in a glass filter with plane-parallel walls

cm light width, which allowed only the red, orange, yellow and yellow-green rays to pass.

the of

I

I) The age difference between the infusoria cultures at the different time points (2,, Z, and Zz) is about 3 weeks.

If a specific killing time is given below without further explanation, it is to be understood that all individuals appear killed on examination immediately after the exposure to light has ceased.

If infusoria are exposed to rock crystal under the circumstances indicated, the action of the light at the various stages of exposure will be seen in the following manner, variations occurring within the different species. As an example I cite the action of light on a Nassula species, which I have used in the majority of the experiments reported here.

With very short exposure times, more lively movements are observed, with the animals swimming around significantly faster than before exposure. The inciting effect of the light emerges clearly in this way.

If the exposure is prolonged, the injurious effect begins to manifest itself in the movements becoming slower. Later rotation about the longitudinal axis begins, but the progressive movement continues steadily, a number of individuals showing a certain tendency to ring movements.

Eventually the movements cease altogether, the infusoria lying motionless in place with unchanged form, but there is constant ciliating and vacuole contraction. They contract on it, with a sharply demarcated membrane together in a spherical shape.

Finally the membrane bursts, the protoplasm escapes and breaks up into fine grains.

As for some forms, e.g. B. Stylonychia, no spherical contraction occurs, the rupture of the membrane and the beginning escape of the protoplasm takes place at a time when the infusoria are still able to swim about freely. Eyelash movement and vacuole contraction often persist relatively long after rupture. Finally, a granular decay also takes place here. As far as can be seen, the infusoria are killed by light1) under about the same phenomena as other investigators have found upon exposure to thermal or chemical agents.

From Table I (Experimental Series 1) it can now be seen that the safe kill time for Infusoria C, which is Nassula in size, when exposed to rock crystal is 24-26 sec if the exposure is made without interruption.

If the same infusorium (Table I, test series 2) is first exposed to light for 5 seconds and then after a minute, which is used for microscopic examination, again for 5 seconds, and then after a minute again for 5 seconds, etc., it is found that the killing time is in in this case is also 24-26 seconds, or in other words is quite the same as in the case where the exposure is made without interruption, in spite of the four 1-minute pauses.

In Table I (Experimental Series 3), made with the same infusorium, the kill time with continuous exposure is 25-30 seconds. If, on the other hand, the exposure is carried out in this way (Table I, test series 4).

That is only exposed for 15 seconds and then resp. , 1, 2, 5, and 10 minutes after stopping the exposure again 15 seconds, so the killing time is unchanged, in the 3 cases about 30 seconds and you actually only start with a 10 minute long break between the two 15 second exposures felt a tendency to lengthen the killing time:

11 Figures of infusoria killed by light are found in SERAPIN: Works of KA Veljaminof's Klinik Vol. I, Petersburg 1902.

2c

5 sec (1 st) + 5 sec inm. n, i. Bel. All dead (in single. (1 m.) + 5 sec. (1 m.)

try again + 5 sec. (1 M.) + 4 sec. 5

a single out1

taken).

5 sec (1 st) + 5 sec inm. ll. t. Bel. All photo

(1 st) +- 5 sec (1 st).

+ 5 sec (1 m) + 6 sec

1

3

25 sec

um 1st i.e. Bel. Most dead that

Rest rotates on the

Job.

30 sec

Unm, nd Bel. All dead.

15 sec (1 m) + 15 sec! Um, well. All dead.
15 pieces (2 sts) + 15 sec. inc. 1st i.e. Bel. All dead-
15 sec. (5 m.) +- 15 sec. inm. 11. il. Bel. All dead (in some

However, try a few, with the exception of those that are still rotating on the spot

and soon die). 25 sec (10 m.) + 15 sec. n. 1st Bel. Almost all dead (s: in

most
search rotate some
very few on the
Job).

Note Unin, and Bel. immediately after exposure; 11th nd
minutes after exposure; St. ii, d. Bel. hours after

Bel.

This phenomenon is of the greatest importance in the application of infusoria to light experiments, in that by a series of interrupted exposures followed by microscopy of the same drop of infusoria one is able both quickly and almost correctly to ascertain the time of killing, and therefore only the time of killing thus found by a few interrupted examinations needs to control. If you find e.g. B. that at 20+20+20+20 sec exposures, where only one minute elapsed between each exposure to note the occurrence of death, almost all individuals are dead, and that at 20+20+20+20 +20 seconds exposure all individuals are dead, it is enough to do an uninterrupted exposure of 80 and 90 seconds to find the exact killing time, which will then be between 80 and 90 seconds.

30 sec

um and Bel. Some dead, most

survivors rotate on

the agency. um and Bel. Almost all dead, the rest

rotates in place.

45 sec

50 sec

Unm, nd Bel. All dead,

clearing; sec seconds; II. Minutes; Rest time s The time which elapses between 2 exposures is given in all cases in minutes or hours included in paranthesis. E.g. 15 sec (10 m.) + 15 sec means 15 seconds exposure, then standing without exposure for 10 minutes (s idle time) and then another 15 seconds exposure.

Unm, n, d, Bel. None dead. Part ro

animals on the spot. 15 sts and bel. Some dead, numerous

rotate in place. 30 sts and bel. Some several individuals

duen dead, numerous rotate on

ler place. I St. and Bel. A part (ɔ: ca. '3) are

dead, the rest rotating on the spot.

30 sec

Unm, n, d, Bel. Some dead, the rest

rotates in place. 15 II.n.il. Bel. Almost all dead, some

these are spherical, others have retained their shape, but there is no protrusion of the protoplasm. The few survivors rotate in place.

1

Control 24 hours after standing is not dead, (unexposed) the movements are lively and their shape

is unchanged.

um and Bel. No dead. More alive

movements. no ro

animals. 24 hours after 1st Bel. single dead.

Control 24 hours after putting down no dead in (unexposed) some attempts but a single one).

This method makes it possible to determine the killing time of the infusoria with the greatest accuracy, so that the differences between the individual test results are often only a few seconds.

That the time of killing found to depend to a great extent on the time for observation after stopping the exposure is evident from Tables II and III, where the experiments are made with Infusorium H., which closely resembles Nassula in shape and size .

From Table II (experimental series 1) it can be seen that the killing time is 45-50 seconds when the observation takes place immediately after the exposure has stopped.

In Table II, series of experiments 2, 3, 4, 5 and 6), the infusoria are resp. exposed for 5, 10, 15, 20 and 30 seconds, and then observed immediately 15 min, 30 min, 1 hour, 2 hours and 24 hours after the exposure was stopped. The result is the following:

When observed immediately after a 5 second exposure, the infusoria are in more vigorous motion, 15 minutes and 24 hours after exposure they appear to behave unchanged as before exposure:

When observed immediately after a 10 second exposure, none are dead, most swimming around more vigorously than before exposure, but a few rotate in place. Resp. 15 minutes and 2 hours later they are apparently unchanged as before the exposure. Observation 24 hours after exposure shows that some of the individuals have become slightly more rounded and thicker than before exposure.

If the exposure has lasted 15 seconds, no dead ones will be found immediately after it stops, but a number of individuals will rotate in place. 15 minutes later, on the other hand, individual dead bodies can be observed. At the observation 1 hour later, about ", are dead, and the rest are rotating on the spot or are slower in their movements than before exposure. At the observation 2 and 24 hours after stopping the exposure, the number of dead is the same.

If the exposure is extended to 20 seconds, a few dead individuals are found immediately after the exposure stops, while almost all the remaining individuals rotate on the spot. In the time that followed, more and more people died, so that at the time of observation an hour after the end of the exposure, about half had died. Resp. 2 and 24 hours later, the number of dead is unchanged.

With a 30-second exposure, you will find a few dead ones immediately after the exposure is complete, most of them rotating on the spot. In the following time, more and more die and when observed after an hour, all of them died without exception.

It turns out, therefore, that if the observation takes place immediately after the exposure in the case mentioned here, the killing time must be normalized to about 45-50 seconds, while it can only be set to about 30 seconds if the observation is only one hour after the exposure takes place.

Furthermore, these experiments show that the maximum for dead is reached 1 hour after exposure, so that the time of killing becomes about the same whether the observation is made 1 hour or 24 hours after exposure.

Corresponding results are given in Table III, where the experiments with the same culture of infusoria are made about 14 days later.

It follows from these statements that light effects can be summed up and that there is an after-effect at a certain point in time after the exposure has been completed. It was

It was of the greatest interest to decide how long after a given exposure it was possible to feel such an after-effect, though direct observation gave no intimation of it.

A closer examination of Tables IV and V, with which infusoria form K, which is a species of nassula, and H, which is about the same size, are experimented, shows that these infusoria have their

well

changed shape when exposed to light for a fraction of the killing time and left until the following day.

In these experiments, the kill time for Nassula (K) is 70-80 seconds when exposed to rock crystal (Table IV, Experimental Series 1).

On the other hand, if the infusoria are exposed to light for shorter periods of time, e.g. B. 10-20 seconds (Table IV, series of experiments 2 and 3), so immediately after exposure nothing about the resp. feeling out of more vigorous or slower movements; the observation 24 hours later found none or only a few dead bodies, but the survivors had changed their shape from slender and elegantly elongated to more stout and shortened; otherwise, however, they were just as lively in their movements as before the exposure.

K

7

control

(unexposed)

24 hours after putting it down is not

dead, rounding or shortening of individuals is absent.

40 sk

Noise. and Bel. No dead masters

roll on the Sucie.

1

The more the exposure time approached the time of killing, the more pronounced the shape change of the survivors was 24 hours later.

S*

After exposure for 30-40 seconds (Table IV, series of experiments 4 and 5), the infusoria were observed 24 hours later to such an extent that they were so rounded and shortened that some had an almost spherical appearance.

The individuals that survived the relatively long exposure times were noted to be calm in their movements and to swim around only slowly. The infusoria in the control dishes, placed at the same time under similar circumstances, on the other hand, had retained their slender form, and swam about freely and vigorously.

Table V also shows that this change in shape is unchanged 2 days later and appears to be reasonably stable once it has occurred.

Those infusoria that had been exposed to such brief exposure that either none or only a few individuals were killed seemed to have retained their ability to form almost unaltered. It is noted, however, that the newly emerging generation consistently had the same slender shape as the pre-exposure dams.

The individual infusoria which survived exposure times beginning to approach the time of killing, on the other hand, appeared to have a greatly diminished capacity for formation, being very slow, and the first generations being generally small and stunted individuals.

In order to decide how the infusoria which had survived shorter or longer exposures behaved to a later exposure, the experiments reported in Tables VI and VII were made.

The experiments made with Infusoria H. (Table VI) were carried out as follows:

After resp. After 5, 10, 15 and 20 seconds of exposure, the dishes with the exposed infusoria were left for 24 hours: at this time the time of killing was then determined.

This was about 50 seconds for the infusoria that had been exposed for only 5-10 seconds (Table VI, Experimental Sets 1 and 2), or just the same as that found for the unexposed infusoria that had been under the same conditions (Table VI, test series 5).

For the infusoria, which resp. 15 and 20 seconds had been exposed (Table VI, test series 3 and 4), on the other hand, the killing time was shorter than for the control animals, namely resp. 30 and 40 seconds. Table VII, experimental kingdoms 1, 2, 3 and 4, where the

, experiments with Nassula (K) were made, show very similar results.

While the killing time for the unexposed control (Table VII, Experimental Series 5) was 70-80 seconds after standing for 24 hours, the killing time for the infusoria containing resp. 10, 20, 30 and 40 seconds of exposure and then, after standing for 24 hours, were exposed again for about 70, 60, 55-60 and 40 seconds.

Table VI (Exposure through rock crystal).

trial

line

Infusorium exposure time + rest time

test result

5 sec (24 hrs)

No dead, no visible down

rounding or shortening. 5 sec (24 hrs) + 20 sec No tol, part rotates (1 m.)

on the spot. 5 sec (24 hrs) +- 20 sec Part dead, rest ro

(1 st) + 10 sec. (1 st) on the spot. 5 sec (24 hrs) + 20 sec Most are dead.

(1 st) +- 10 sec (1 st)

+ To sec (1 m.)
15 sec (24 hrs) + 20 sec All dead.

(1 st)+ 10 sec (1 st)
+ 10 sec (IM)+ 10 sec

10 sec (24 hrs)

No dead, most In

dividers are slightly more rounded and thickened

than before exposure. | 10 sec (24 hrs) + 20 sec None dead, most ro. (1 st)

animals on the spot. | 10 sec (24 hrs) +- 20 sec Part dead, rest ro

(1 st) + 10 sec (1 st). on the spot. 10 sec (24 hrs) + 20 sec Most are dead.

(1 st) + 10 sec (1 st)

+ 10 sec (1 st)
10 sec (24 hrs) + 20 sec All dead.

(1 M) + 10 sec. (1 M.)
+ 10 sec (1 m)+10 sec

15 sec (24 hrs)

Some dead, the rest gone

rounded and thickened. 15 sec. (24 hrs.) + 20 sec. Part dead, the rest ro(1 m.)

on the spot. 15 sec (24 hrs) + 20 sec All dead in some Ver(1 M) + 10 sec (1 M). however, are looking for a single one

excepted).

15 sec (24 hrs) + 20 sec

All dead.

(1 st) + 10 sec (1 st)

+ 10 sec

20 sec (24 hrs)

Numerous dead who survive

den are rounded and

thickened. 20 sec (24 hrs) +- 20 sec Some several dead, the rest (1 m)

Killed on the spot.

o sec (24 hrs) ɔ: Control None dead, no shape

(unexposed)

change _

o sec (24 hrs) + 20 sec Almost all dead.

(1 st.) +- 20 sec. (1 st.)

- 5 sec

o sec (24 hrs) + 20 sec All dead.

(1 st) + 20 sec (1 st).

+ 10 sec

20 sec (24 hrs)

Some dead, the rest free

movable. 20 sec (24 hrs) + 20 sec single dead, few (1 m)

rotate in place. 20 sec (24 hrs) + 20 sec some dead, almost all the (1 st) + 10 sec (1 st) remaining rotate on the

Job. 20 sec (24 hrs) + 20 sec numerous dead, the rest ro

1 st.) + 10 sec. (1 st.) on the spot. + 15 sec (1 st)

30 sec (24 hrs)

About half dead, the rest

versatile. 30 sec (24 hrs) + 20 sec No larger number dead, I 1.)

most survivors

rotate in place. 30 sec (24 hrs) 20 sec Most dead, rest

(1 st) + 20 sec. (1 st) rotates in place. 30 sec (24 hrs) + 20 sec Almost all dead.

(1 st) + 20 sec (1 st)

+ 10 sec (1 st)
30 sec (24 hrs) + 20 sec All dead.

(1 st) + 20 sec (1 st)
1 + 10 sec (1 st) +- 10

sec

o sec (24 hrs) s Control Everyone is alive and free. (unexposed).

movable. o sec (24 hrs) + 20 sec None dead, single rotate (1 st)

on the spot. o sec (24 hrs) + 20 sec Part dead, most (1 m) + 20 sec (1 m) survivors rotate up

the agency. o sec (24 hrs) + 20 sec Most dead, the rest

(1 st) + 20 sec. (1 st) rotates in place. + 20 sec (1 st)

trial

line

Infusorium exposure time + rest time

o sec (24 hrs) + 20 sec

(1 st) + 20 sec (1 st) + 20 sec (1 st) + 10

sec. (1 m.) o sec. (24 hrs.) + 20 sec.

(1 st) + 20 sec (1 st) + 20 sec (1 st) + 10 sec (1 st) +- 10 sec

10 sec (48 hrs)

10 sec (48 hrs) + 50 sec

(1 st) + 35 sec.

20 sec (43 hrs)

20 sec (48 hrs) + 50 sec

(1 st) + 30 sec 30 sec (48 hrs)

30 sec (48 hrs) + 50 sec

(1 st) + 20 sec.

K

40 sec (48 h)

40 sec (48 hrs) + 50 sec

(1 st) + 10 sec.

o sec (48 hrs) ɔ: control

test result

Almost all dead.

All dead.

None dead, some individuals

slightly rounded but freely movable.

All dead.

None dead, most are

quite strongly rounded and thickened but freely mobile.

All dead.

Some dead, those who survive

den rounded but free to move, but not slower than before d. Exposure.

All dead.

Quite numerous dead, the

Rest strongly rounded and

less agile in the

movements.
All dead (in some

look for a single
taken).

(unexposed).

No dead, no formver

changes , movements are brisk.

Almost all dead.

o sec (48 hrs) + 50 sec

(1 st) + 30 sec (1 st)

+ 10 sec o sec (48 hrs) + 50 sec

(1 st) + 30 sec (1 st) + 20 sec

All dead.

In test series 6 9 the infusoria were resp. 10, 20, 30 and 40 seconds exposed. After standing for 48 hours, the survivors had a killing time of resp. 85, 80, 70 and 60 seconds, while it was about 90-100 seconds for the control (Table VII, test series 10), which had not been exposed but had also stood for 48 hours.

From the experiments here described it is evident, therefore, that infusoria which have been subjected to insufficient exposure to light to kill them, are much less resistant to subsequent exposure, and where the first exposure is not too brief has been, the kill time appears to be almost equal to the sum of the two exposure times, but such that this is only true within the first 24 hours.

After exposure 48 hours later than the original one, the earlier exposed individuals also showed significantly lower resistance than the unexposed ones, but it did appear that some of the original exposure to light was lost here, with kill times generally being longer than the sum of the original and later exposure times.

It turns out, therefore, that within the limits examined here, there is no question of any kind of habituation to the light.

From the experiments which I have hitherto made, the new generation does not appear to have acquired any greater power of resistance to the injurious influence of light than the Infusoria descended from individuals which have not been exposed to light.

The former are more sensitive because, as mentioned earlier, they are often smaller and apparently not as strong individuals. It seems to me impossible to express myself with certainty on this question, as the same infusoria are at different times so differently sensitive to the action of light, a circumstance which will be more clearly illustrated by the following experiments.

After the above-mentioned observations on the action of light on infusoria in general, I will now give a comparative account of the sensitivity of the various infusoria to light of different qualities .

Here it was immediately of interest to obtain information about the extent to which a connection could be demonstrated between the size of the various species of infusoria and the speed with which they were killed by light.

In Table VIII one finds the various killing times listed for the II different Infusoria species described in more detail on pages 1 and 2, with exposure to resp. Rock crystal, clear glass, blue glass and a 5% monochromatic potassium solution:

If one considers the killing times for the infusoria when exposed to light from rock crystal, it is immediately apparent that there is not the slightest connection between the killing time for the infusoria in question and their size. While it takes 70-80 seconds to kill the small Dysteria (L), the large species (A) only requires 11-12 seconds of exposure. Another

on the other hand, the small species (B) is killed in 7-8 seconds of exposure, while the kill time for the large species (I) is 60--70 seconds.

If one also considers the infusoria within the individual groups, one finds for group 1 (the small

50% monochrome.

Kali

30-35 mins

70-75 mins

8-9 mins

infusoria) that the killing time for L is ten times as long as for B. As for group 2, the killing time for K is 7-8 times as long as for D. And finally within group 3 the killing time for I is 6 times as long as for A

Infusoria of the same size are also of different resistance to the lethal action of light.

Now that it was proved that the very unequal sensitivity of the individual species of Infusoria was not related to their size, it might be conceivable that their greater or lesser transparency, or their pigment content, might be decisive in the time of killing. The experiments done, however, yielded nothing that would suggest this.

It is conceivable that the pigmentation could prevent the penetration of light, and that accordingly the highly pigmented infusoria required a relatively longer time to kill; this does not appear to be the case, in which Stylonychia (I), which is pigmented, is killed more rapidly than Dysteria species (L), which is almost entirely clear and translucent.

On the other hand, it would be conceivable that the content of colored grains would significantly reduce the killing time by absorbing the light; but also in this respect the experiments do not seem to allow any conclusions to be drawn. While infusorium was your quite opaque infusorium with numerous pigment grains, H was, so to speak, completely clear; nevertheless, the killing time for the latter was 4 times as long as for D.

The different susceptibility of the individual species of Infusoria to the killing action of light is therefore in best agreement with their well-known unequal powers of resistance to mechanical, thermal, and chemical influences.

After this demonstration, it was therefore of interest to decide whether the relative sensitivity of the different species of Infusoria to the different qualities of light was the same, although their absolute sensitivity was different.

One has only to glance at Table VIII, where the various killing times are given, and at the accompanying curves, to see how exceedingly unequal is the relative sensitivity of the various species of Infusoria to the various qualities of light. However, they all have in common that they are most affected by the most refractory rays.

In the curves the killing times in minutes and in fractions of a minute are marked out along the ordinate, while the various absorption media are marked out along the abscission, so that one has rock crystal furthest to the left, then clear glass, then blue glass and finally 5% monochromate potassium solution .

While the killing time for the infusoria Bnnd F resp. 120 and 133 times longer when exposed through clear glass than when exposed through rock crystal. whereas the killing time for) is only twice as long when exposed through clear glass as when exposed through rock crystal, or in other words, B and F are about 60--65 times more sensitive than ¿ to the rays passing through rock crystal , but not through glass s the ultraviolet. Between these contrasts for the sensitivity to ultraviolet rays, as can be seen from the curves, there are several transitions.

The ratio between the killing time when exposed to resp. Rock crystal, blue glass, clear glass and 5% monochromatic potassium is now for the various

0

monochr. kali

Forms where kill time in rock crystal is chosen as a unit, follows.

The experiments with J, L, and K meanwhile show that the infusoria are not only so differently sensitive to ultraviolet rays, but that this also applies to long-wave rays.

For / the killing time is 7-8 times as long for exposure to monochromatic potassium as for exposure to rock crystal, while it is longer for L and K, respectively. 22 and 42 times as long, or in other words. J is resp. 3 and 6 times as sensitive as Lund K to the rays which pass through monochromate potassium.

The curves clearly show that these differences in the relative sensitivity to the different light qualities are not related to the size of the infusoria.

Considering e.g. B. the curves for the two medium-sized forms, C and K, are found to be as different as possible, although the size is the same.

On the other hand, if one compares the curve for the medium-sized form C with the curve for the large form E, a complete coincidence is found, notwithstanding the size differences, which are important for the two species.

Finally, comparing the curves for J, L, and K, where] is a large form, L a small one, it is found that 3 forms so widely different present highly unequal curves.

From these three curves it is also evident that the greater or lesser sensitivity to the rays which pass through monochromatic potassium also does not depend on the size of the species, since the large species (1) is about 3 times more sensitive to these rays like the small species (L), while on the other hand it is twice as sensitive to these rays as the medium-sized species (R).

From what has here been given it is sufficiently proved that there are species of Infusoria which show a colossal sensibility to the highly refractory ultraviolet rays, while there are species which are only slightly more affected by these than by the long-wave yellow and yellow-green rays will.

All possible transitions seem to be found between these contrasts.

In connection with this I would now like to mention that the same species of infusoria can sometimes at different times show not only absolute but also relatively different sensitivity to different qualities of light. These variations, however, as is also evident from Table IX, are insignificant in comparison with the great differences exhibited by certain species of Infusoria.

It is not impossible that the relationship mentioned here can be traced back to senile degeneration, as MAUPAS has demonstrated, and this and that could speak for it, but I have not yet carried out any detailed investigations to clarify this question.

From this it follows that, with regard to the infusoria, we are able, with the help of light, to obtain easily the various species of infusoria in pure culture, by using their different sensibilities to the different qualities of light. A possibility which I have already indicated in an earlier treatise on the amoebas, and which has given excellent results here for the infusoria, where it is a question of obtaining certain forms in pure culture.

The results of the reported experiments can be collected in the following résumé:

The infusoria become strong, but affected in varying degrees by the light. With a very short exposure, they become more lively in their movements (incitation), with a somewhat longer exposure, certain species change their shape (contraction), which lasts a long time. With an even longer exposure, they die. Sometimes they burst before, sometimes after death. Some species die after a short exposure, others after a much longer one; however, this ratio is not dependent on size or pigmentation. Different species show different sensitivity to different qualities of light, both in absolute and relative terms. B. Some species have a very high sensitivity to ultraviolet rays, others a low one.

A single, non-fatal, deleterious exposure to exposure can be felt for up to approximately 48 hours after exposure.

The offspring of infusoria which have been exposed to reasonably long exposure appear feeble and stunted, and sometimes appear to lose the ability to reproduce altogether.

The effect of the exposure is, within certain limits, the same whether it is continuous or interrupted by not too long intervals (about 5 minutes), provided the total exposure time is the same in both cases.

When infusoria are exposed to light, there is an after-effect which can be recognized partly by the fact that the observed killing time becomes shorter the later after exposure the observation takes place, and partly by changes in shape (rounding off).

vii

sensitization of

microorganisms and animal tissues.

Of

Georges Dreyer.

In the same meaning as elsewhere in photography, the word "sensitization" is used here in photobiology and thus means that microorganisms and animal tissues, like photographic plates, are sensitive to light rays of a quality when treated with certain substances, "sensitizers". can be made to which they were either insensitive or poorly sensitive prior to sensitization.

Before I give a more detailed description of my experiments and their results, I want to briefly discuss some studies, primarily by German authors, on the different toxicity of certain fluorescent substances in the light and in the dark.")

DANIELSOHN 2) found that some acridine derivatives were more toxic to Paramecia when the mixtures were left in ordinary daylight than when left in the dark, and ULLMANN 3) made exactly the same observation, using unconcentrated electric arc light instead of daylight.

1) An overview of those investigations, which we owe to the pharmacological institute in Munich, is available from Professor H. von Tappeiner in Munich med. Weekly published January 2, 1900 and November 5, 1901.

2) Danielsohn, On the Effects of Various Acridine Derivatives on Infusoria. dissertation Munich 1899.

3) Ullmann, On the Effects of Electric Arc Light on Microorganisms in the Presence of Fluorescent Substances. dissertation Munich 1901.

to

JACOBSEN 1) proved that the ciliated epithelium from the pharynx of the frog, suspended in various poisonous fluorescent liquids, stopped flickering faster in the light than in the dark. He thought that the increased toxicity in the light could possibly be attributed to the fact that the effect of fluorescence changed the osmotic ratio of the cells.

RAAB 2) examined the action of a whole series of fluorescent substances (e.g. acridine, quinine and eosin) on Paramecia and determined that the toxicity was considerably greater in daylight than in the dark. He proved that no increase in the toxicity of the liquids took place as soon as they were exposed to light and placed in the dark after the addition of the Paramecia. Like Jacobsen, he emphasized that the fluorescent light as such was of no importance in explaining the phenomenon, but stated that the rays which produced the strongest fluorescence were the most effective.

He also made the interesting observation that mice injected with a little less than the lethal dose of eosin and then placed in sunlight developed necrosis of the ears after 1-2 days, which he tries to explain in this way: Probably rather because of that injected eosin absorbs more heat-transforming rays and simply burns the ears.

RAAB also tested the effects of various fluorescent substances on bacteria, but with no results. Finally, I would like to mention the Frenchman LEDOUXLEBARD 1) who, like RAAB earlier, observed that Paramecia suspended in thin eosin solutions died faster in daylight than in the dark. Contrary to RAAB, however, he claimed that the cause was that the active rays changed the composition of eosin and produced a substance in it that was poisonous to Paramecia. He found that if an eosin solution was first exposed to light and then placed in the dark after the addition of paramecia, the paramecia died faster in it than in an unexposed eosin solution which was also kept in the dark. killing normal nassula as with exposure to rock crystal, the killing time for the sensitized infusoria is exactly the same whether the exposure is to dichromated potassium or rock crystal, such that the sensitized infusoria exposed to dichromated potassium are 660 times faster than the normal ones to be killed. killing normal nassula as with exposure to rock crystal, the killing time for the sensitized infusoria is exactly the same whether the exposure is to dichromated potassium or rock crystal, such that the sensitized infusoria are killed 660 times faster than the normal ones by exposure to dichromated potassium will. action of erythrosnis, it follows that the killing time for sensitized and normal bacteria is the same when exposure occurs through rock crystal and clear glass, which would not be the case if it were a direct inhibition induced by erythrosin of growth acted. Incidentally, the growth of bacteria was at least as plentiful in the sensitized as in the normal cultures.

1) Jacobson, About the effect of fluorescent substances on ciliated epithelium. journal for Biology Vol. XLI, 1901.

2) Raab, On the Effects of Fluorescent Substances on Infusoria. Journal of Biology Vol. XXXIX, 1900 and: Further investigations into the effect of fluorescent substances. Ibid. Vol. XIVL, 1902.

After these introductory remarks I want to proceed to the discussion of my experiments and experimental results.

Infusoria (a Nassula species) are mainly used as test objects and all my basic experiments are carried out with them. In addition, experiments have been carried out with bacteria and various animal tissues.

The reason why I have used a species of Nassula for the experiments with infusoria, while all the above-mentioned researchers without exception made their experiments with Paramecium candatum, is that the Nassula species is an infusoria quite resistant to mechanical insults, while the Paramecia even for very slight damage such. B. only careful suction in the pipette, among other things, are very sensitive, which for the

a same attempts is very disadvantageous, in which one ge

wishes to rule out any side effects as far as possible.

A number of different substances, some fluorescent and some non-fluorescent, were tried as sensitizers. These were used in such weak solutions that it was not possible to feel any toxic effects beyond sensitizing. Of the substances tested, erythrosine (sodium tetraiodofluorescein) proved to be the best sensitizer, which is why it was used in all the experiments described below.

A carbon arc lamp was used as the light source and a FINSEN concentrator with rock crystal lenses was used to concentrate the light. The distance from the top of the positive carbon to the nearest lens in the concentrator was 11.5 cm. The lamp burned with 30 amperes and 49 - 50 volts. The quartz dishes with infusoria and bacteria were placed in the cone of light below the focal point, where its diameter was about 1.2 cm and was always perpendicular to the direction of the beam. Cold water was sprinkled over the dishes during the exposure, eliminating any heat effect.

With the infusoria the experiments were also carried out in the following manner. One cbcm of infusoria culture (Nassula) was measured into two test tubes, 1 cbcm of distilled water was added to one glass A. and 1 cbcm of erythrosine solution was added to the second glass B.

These and even higher concentrations proved to be as non-toxic to Nassula as simple dilution with water, in that the infusoria lived in both test tubes for the same length of time, ie 6-7 weeks, and showed themselves to be no more sensitive to the effects of different chemicals.

1) Ledoux - Lebard, Action de la lumière sur la toxicité de l'éosine et de puelques autres substances pour les paramécies. Annales de l'instil, Pasteur No. 8. 1902.

The infusoria in glass A are called normal, those in glass B are called sensitized.

The jars with the mixtures stood constantly for at least 1/2 hour before use. Hanging drops of the mixtures mentioned above were now placed in quartz chambers, which are described in more detail in an earlier paper 1). The size of the drop was as uniform as possible in all tests, approx. 0.5 mm at its greatest thickness. A thin layer of distilled water in the bottom of the dish prevented the drop from drying out.

Exposure was done in part so that there was an effect of the whole visible spectrum, including the ultraviolet rays, when exposed to rock crystal alone, and such that various portions of the visible spectrum were eliminated.

The switching off was effected by placing various absorbing media (filters) in the light cone between the concentrator and the shells. The various absorbing liquids were filled into a glass light filter with plane-parallel walls and a width of 1 cm.

1. Clear glass (light filter filled with distilled water) was used, which allowed the entire visible spectrum to pass during spectroscopy.

2. 5% nickel sulphate solution containing the red, orange, yellow, green, blue and some violet rays,

3. Blue glass, which emits blue, violet, and a part yellow and green and many red rays,

4. 3% ammoniacal solution of sulphate of copper dioxide, which is blue, violet, and some blue

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1) GEORGES DREYER, The Effects of Light on Amoebas. Messages from Finsens mcd. Lys Institute IV, 1903.

yellow-green rays, but significantly fewer of the latter than the blue glass,

5. 5% solution of monochromatic potassium, which red, orange, yellow and yellow-green rays and finally

6. 5% solution of bichromate of potassium, which allowed red, orange, and yellow rays to pass.

The results of experiments on infusoria are clearly shown in the table below and the curves in Plate I, where the killing times are given in minutes or parts of a minute along the ordinate, while the various absorbent media (filters) are separated along the abscissa, so that one furthest to the left has rock crystal (see: the entire visible spectrum plus the ultraviolet rays), then clear glass, etc

The bottom curve gives the killing times for the sensitized, the top curve the killing times for the normal nassulae.

Kill time for Nassula

filter

sensitized

normal

100 sec

ok

9 mins

1o

rock crystal

10 sec Clear Glass (Cl. Gl.) 5", Nickel Sulfate (5", NISO,) Blue Glass (Bl. Gl.)

25 3o., copper sulphate (3°'CuSO,)

50 5", monochromate potassium 15% K, CEO) 5", dichromate potassium 15", K,C1,0) 10

, % ,

14

0

20

ok

0

0

2

99

The extraordinarily large difference in sensitivity to light between the sensitized and the normal infusoria can be seen directly from the table. Whereas exposure to potassium bichromate requires a time 66 times as long to

whale

jacket,

The reason for the relation here touched on is that the infusoria are made more or less as sensitive to yellow and yellow-green rays as they were before sensitization to the ultraviolet rays.

After that let's move on to the bacteria experiments '). These are carried out with B. prodigiosus by propagation, partly in ordinary agar, partly in agar to which erythrosine has been added in a ratio of 1/5000 immediately after propagation.

1 cbcm of these mixtures was then placed in quartz dishes with a diameter of 3.9 cm, whereupon exposure took place by sprinkling water over the dishes to avoid the heat effect. A culture that was about 20 -- 24 hours old was always used.

After exposure, the dishes were placed in the thermostat at 22°C, and the experimental results were observed 2 days after exposure.

1) These experiments form one link in a series of experiments which I, together with Dr. Jansen to determine the sensitivity of different bacteria to different qualities of light, both in the normal and in the sensitized state.

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Kill time indicates absolute kill.

The results can be seen from the above table and the curves in Panel II, where the bottom curve gives the killing times for the sensitized B. prodigiose, the top for the normal ones.

From this it follows that while the killing time for the sensitized bacteria is only about 18 times as long when exposed to potassium double chromate than when exposed to rock crystal, this relationship is quite different for normal bacteria, where the killing time when exposed to potassium double chromate is about 405 times as long as exposure through rock crystal. In other words, the sensitized bacteria are killed about 25 times as fast as the normal ones when exposure is made to dichromated potassium. The reason why the absolute numbers and the shape of the curve in bacteria differ from that of the infusoria is that the bacteria are far more sensitive than the infusoria to the ultraviolet, violet, and blue rays.

That the difference in sensitivity to light highlighted here is not one that inhibits growth

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BOW.

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That the difference in sensitivity to light highlighted here is not one that inhibits growth

The fact that we are dealing here with a sensitization to the yellow and yellow-green rays is clearly evident from the infusoria experiments, where the killing time for the sensitized individuals when exposed to blue glass and copper sulphate solution or 2/2 and 5 times that of exposure to rock-crystal, this being due to the blue glass retaining a portion, and the copper sulphate a still greater portion, of yellow and yellow-green rays, while the killing time on exposure to dichromated potassium, which the yellow ones Lets rays pass is the same as exposure through rock crystal.

For bacteria, the relationship is clearly evident from the following experiments, where a Koch plate method culture in agar of sensitized resp. normal B-prodigiosi was exposed to the light of a projection carbon-arc lamp (20 amps and 55 volts) for 30 minutes, after first refracting it through a quartz lens. After exposure, the Petri dishes containing the Koch's plate method cultures were thermostatted at 22°. When viewed 2 days after the exposure, the following result was obtained:

The sensitized bacteria were totally killed in both the part where the ultraviolet and the part where the yellow and yellow-green part of the spectrum had worked. For the normal bacteria, on the other hand, the ratio was such that there was killing only where the ultraviolet part of the spectrum had acted; while no effect could be felt on the part affected by the yellow and yellow-green rays.

It has previously been shown that the rays of light most powerful on microorganisms and animal tissue (see the so-called chemical, blue, violet and ultraviolet rays) have only a very small ability to penetrate through animal tissue), while the rays (see the red, yellow, and yellow-green) which affect microbes and animal tissues to only a slight degree, have a significantly greater ability to penetrate deeply).

In order to determine in more detail how enormously important the sensitization for yellow and yellow-green rays is for the depth effect, I have carried out the following experiments with exposure of sensitized resp. normal infusoria (nassula) through skin of varying thickness.

Formulated human skin was used for the experiments. The objection could be raised that living and dead skin do not behave in the same way. However, if one takes the exposure through a rabbit ear which has been ischemiad by pressure, then cuts off the same ear, formulates it and then exposes again through the same, the formulated ear becomes at least one flat

1) HANS JANSEN, Studies on the ability of bactericidal light rays to penetrate through the skin. Message from Finsens med. Lys Institute IV, 1903.

2) GUNNI BUSCK, About the relative penetration ability of the different. those spectral rays compared to animal tissue. Message from Finsens med. Lys Institute IV, 1903.

1 0.5 475.

2

mm

hold back as great a quantity of effective light as the living ear.

The different skin thicknesses were achieved by superimposing several pieces of skin. The skin pieces were placed at a distance of

placed in front of the quartz plate by placing 2 square pins between the skin and the quartz.

This arrangement was made to ensure cooling by sprinkling water over both the quartz plate and the skin in front of it, eliminating any heat effect.

The results are clearly evident from the attached table and the curves in Panel III, where the bottom curve indicates the killing times for the sensitized, the top for the normal infusoria. The killing times are plotted in minutes or fractions thereof along the ordinate, while the thickness of the skin through which exposure took place is plotted along the abscissa in millimeters or fractions of a millimeter.

From this it can be seen that the sensitized infusoria go through a skin layer of 0.5 mm and resp. 120 and 160 times as fast as the latter were killed by a skin layer of 0.75 and 1.25 mm. There's already an hour's notices from the 2nd Finsens Medical Light Institute. vii

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was necessary to kill the normal infusoria when exposed to light through 1.25 mm thick skin, no attempts were made with thicker layers of skin in this regard.

It is clear from the experiments last reported that it is possible, within very short times, to achieve killing of sensitized infusoria by exposure through skin layers where it was absolutely impossible to kill non-sensitized infusoria even if exposure was continued for hours. This circumstance can be explained by the fact that the yellow and yellow-green rays, in contrast to the ultraviolet rays, have a relatively high penetration capacity.

The following experiments show that very similar conditions also apply to bacteria. Sensitized and normal Koch plate methods - cultures of B. prodigiosus in agar were exposed through 1.25 mm thick skin (same experimental setup as tried for the infusoria). While the sensitized bacteria were totally killed with a 20 minute exposure, the kill time for the normal bacteria was at least 11 hours.

Insofar as the facts obtained here about the possibility of sensitizing animals and plant organisms should have more than theoretical significance, it would be necessary to prove that the animal tissues of higher organisms could also be sensitized to otherwise ineffective qualities of light.

The following experiments show that this is possible:

3/4 cbcm of a 1% erythrosine solution was injected into the back lymphatic sac of a frog.

These, and even doses up to 2-3 cbcm, had no proven harmful effect on frogs.

A few hours later the frog was anesthetized with urethane, placed prone, the tongue extended on a Cohnheim's tongue table, and exposed to a concentrated arc light of the same intensity as in the first-mentioned experiments. During the exposure, the tongue was covered with tinfoil over its largest extent; a cut-out 4 cm wide and 1/2 cm long was only made corresponding to the one corner to be exposed. A light filter containing 5% monochromatic potassium was inserted between the tongue and the concentrator. 16

During exposure, the tongue was sprinkled with physiological (0.65%) saline solution (Tp. 10–12° C.), which ruled out the heat effect.

After 8 minutes of exposure, direct microscopy of the tongue was performed, which now showed the following typical picture: According to the exposed area, severe edema, vasodilatation and thrombosis of the capillaries and smaller vessels were present both on the surface of the tongue and on the papillary side averted from the light.

On the following day there was also thrombosis of the large vessels throughout the thickness of the tongue and some emigration of cells. The unexposed half of the tongue showed normal conditions.

If, on the other hand, the tongue of a normal frog is exposed to rock crystal for the same period of time, 8 minutes, so that the entire visible spectrum including the ultraviolet rays takes effect, the following picture emerges: oedematous swelling, vasodilatation and thrombosis of only the fine superficial capillaries ; but the depth of action is so slight that the circulation on the papillary side of the tongue is entirely unhindered, even in the finest capillary loops. On the following day there is also a slight emigration of white blood cells.

Will such an unsensitized tongue be like this. If only a clear glass plate is switched on in the cone of light in front of the tongue, even an exposure of 20 minutes will produce no visible effect, except perhaps a somewhat more lively circulation in the finer vessels.

You can see that while the normal frog tongue only has a very superficial effect, the relationship is quite different with the sensitized tongue, in that the effect goes through the depths of the entire tongue.

I also carried out the following experiments with rabbits: 110 cbcm of a 1% erythrosine solution was injected into one ear of a rabbit. Injection of this and even larger amounts did not produce any local irritation phenomena, and 2-3 cbcm, of a 1 solution could be injected directly into the veins without being able to feel any harmful effects.

The experiment was extended so that both ears were placed one on top of the other and after a light filter with 5% monochromatic potassium solution had been switched on, it was placed in the light cone in such a way that the light penetrated the normal ear before it hit the sensitized one. In this case, the warming effect was eliminated by placing the two ears, one on top of the other, between two flat pressure glasses through which cold water flowed. It was exposed for 1 hour.

As a result, 1 and 2 days after exposure, the normal ear, through which all light had passed, showed no reaction at all, while the sensibili showed a clear light reaction with hyperemia, edematous infiltration, etc.

Tests on people have shown that it is also possible here to evoke sensitization to otherwise ineffective qualities of light.

It should come as no surprise that, given the current status of the question, it is not possible to give a reasonably well-founded explanation of the above-mentioned sensitization phenomena; for although 30 years have passed since the sensitization of photographic plates (VOGEL 1873) it has not yet been possible to explain the actual nature of sensitization.

In conclusion, I will therefore confine myself to discussing the following facts, which could possibly contribute to an understanding of the question of sensitization to microorganisms and animal tissue.

1. The fluorescence is not the decisive factor in sensitization, because there are substances which fluoresce strongly and yet either sensitize only weakly or not at all (esculin, fluorescein), and on the other hand there are substances which do not fluoresce but can nevertheless sensitize. (cyanine).

2. Absorption is not critical either, for there are both fluorescent and non-fluorescent materials which absorb strongly and yet are not sensitizing to the rays they absorb.

3. The sensitization is hardly based on the fact that the sensitizers form toxic substances during exposure, which adversely affect the microorganisms and animal tissues; because if a sensitizer such. For example, if erythrosine is first exposed to light for 10 minutes and then used for sensitization immediately after exposure, its sensitizing ability is significantly reduced, as can be seen from the attached table.

In view of the experiments reported here, the ear necrosis observed by RAAB in eosin-poisoned mice must be attributed to direct exposure to light, possibly with sensitization to yellow-green and green rays, rather than to simple combustion, as he states.

My test results can be summarized in the following résumé:

By using certain sensitizers it is possible to penetrate microorganisms and animal tissues as well or even to a higher degree for the otherwise ineffective but relatively strong ones. to the yellow and yellow-green rays, as is normal to the powerful but little penetrating chemical rays.

viii

Studies on the resistance of the tumor

cells to intense light.

Of

CO Jensen and H. Jansen.

Very little is known for certain about the harmful effects of light rays on the cells of warm-blooded animals. Investigations of this kind are associated with great difficulties. Exposing the skin to an intense effect of actinic light rays will cause inflammation and this, together with its consequences, will easily completely mask the changes in the cells that the exposure to light could have caused directly.

One must therefore use torn cells; but as a rule one cannot tell from their microscopic appearance here whether they are killed, damaged, or completely undamaged. This is true even for ciliated cells, since there is little justification for considering the cessation of fibrillation motion as evidence of cell death.

Exposing the cells and tissues and verifying by transplantation whether they remain alive or non-living also presents difficulties; partly the transplantations of normal succeed

Tissue by far not always, sometimes it can be difficult to recognize the transferred tissue again and thus to confirm continued viability.

As a rule, pathological tissues cannot be used for such experiments either, but there are certain forms of tumors which can be so easily transmitted from animal to animal by vaccination that they can be used to advantage in experiments such as those mentioned.

In the last 2 years one of us (JENSEN) has carried out extensive experiments with such a tumor form on a white mouse. The tumor, which shows a carcinomatous structure but does not give rise to metastases, can be easily transplanted to other white mice, about half of the inoculated animals showing growth of new tumors. According to the experiments available, it may be regarded as certain that the tumor is not of infectious origin. The tests mentioned include, among other things, the resistance of the tumor cells to heat, cold, drying out, etc.').

As a link in this series of studies, the following (?) Studies on the resistance of tumor tissue to the effects of intense chemical light were made.

A FINsEnscher concentration apparatus 3) was used for exposure, as is used for the treatment of lupus patients. The light source was a coal

1) CO JENSEN, Experimental Undersógelser over Kraft bos Mus. (Experimental studies on cancer in mice). Hospitalstid. No. 21 and 22, 1903 and Centralblatt für Bacteriologie XXXIV, no. I and 2.

2) Essentially identical to the corresponding section of the paper in the Centralblatt.

3) NR FINSEN, La photothérapie, 1899 and information from Finsens med. Lys Institute III p. 38, Leipzig 1903.

20mm

arc lamp of about 70 (65-70) amperes, the current strength about 50 (48-51) volts; the thickness of the coal 30 mm

the diameter of the front lens was 8 cm, its distance from the light source was 13 cm. The light intensity corresponded essentially to that used in the treatment of lupus.

The experiments were carried out as follows: the mouse was sacrificed, the tumor excised, placed in a sterile glass dish, and small pieces cut out of the least decomposed parts. An apparatus constructed and illustrated earlier was used for exposure, which consists of 2 quartz plates, which are mounted in a brass mount in such a way that they can be more or less pressed together. We placed the pieces of tissue between the quartz plates and pressed them against each other so that we got an even, thin layer of half-crushed tumorous mass. As far as possible we avoided the use of pieces of tumor which had decayed parts or visible amounts of blood. We placed the small quartz capsule with the tumor tissue in the cone of light of the concentrating apparatus at such a distance from the latter that it was slightly behind the focus at a point where the cone had a diameter of 18 mm. By sprinkling water over both sides of the quartz box we prevented the tissue pieces from heating up to temperatures above 25-30°C.

After various periods of exposure, we inoculated the tumor parts in the usual manner 5) into the subcutis of white mice; As a rule, 5 mice were used for each experiment, and for the sake of safety, the same number of mice were always inoculated at the same time with unexposed parts of the tumor tissue.

4) HANS JANSEN, Studies on the ability of bactericidal light rays to penetrate through the skin. Messages from Finsens med. Lys Institute IV, p. 37, Jena 1903.

5 series of trials have been carried out so far; the first with thicker layers of tumor mass, the others with 0.2 mm thick layers. In the first two test series, the tissue was only exposed to light from one side; in the others, however, the quartz capsule was turned after half the exposure time had elapsed so that the

opposite surface was now facing the light source; this achieved uniform exposure of the entire tissue mass.

The results of the tests can be seen from the tables below.

I hour

15 minutes.

5

(Not

5 5 5 5

Test series I. (The current at

weaker in this experiment, about 60

4

control

3

amps)

exposed)

0.2mm

2 hours

i hour

5

5

4

5

5 5 4 2

| || .ى _

Test series II

control

I

(not exposed)

5) Approximately 1 mm pieces were carefully cut into the end of a sharp. ground canyle attached, this was inserted under the skin of a mouse and the tumor piece was pushed into the subcutis by means of the stylets.

When the tissue was a millimeter thick, the rays of light could not penetrate to the extent that the tissue was killed, even by prolonged exposure. With a tissue thickness of 0.5 mm, exposure to light for 15 minutes was not sufficient for this purpose, while exposure to light for only 1/2 hour with a layer 0.2 mm thick would definitely have a fatal effect on the cells.

The following series of experiments were all three carried out in the same way, with the same thickness of fabric and with both sides exposed (see above).

Test series Ill-V.

thickness of

Number of Too soon Mice with Mice with

Duration of

tissue

exposure

vaccinated dead negative positive mass

mice mice result result

It is evident from this that the intense light kills the geschult cells easily. It is difficult to decide how short the exposure needs to be in order to to kill the individual cells; from the last two series of experiments, however, it can be seen that all tissue parts of a layer 0.2 mm thick were killed after the lapse of 1-2 minutes if, as stated, the exposure had hit both surfaces of the layer alternately. In agreement with earlier experiences and observations, the experiments have shown that the active rays of light are capable of penetrating the tissues only to a comparatively small degree, and that their effect on the cells ceases after they have passed through a layer of tissue only 0.5 mm thick , is already considerably weakened, even if exposure to light for more than 15 minutes will probably destroy a layer of tissue of this thickness.

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foreword

In the literature of the last hundred years (since EdWARDS "Observations 1824) there is a very significant number of observations and investigations on the biological effects of light.

Frequently, however, the quality of these does not correspond to the quantity, which is a natural consequence of the difficulty in distinguishing the effects of light from those of other simultaneously occurring agents, e.g. B. heat to separate. It is also a peculiarity of the phenomena caused by light that they often arise from an accumulation of numerous, small, hardly identifiable influences and are therefore easily misjudged. In spite of the numerous investigations, our knowledge of the biological effects of light has been very limited, ie very unreliable. However, the investigations into the effect of light on plants, bacteria and the skin must be partially excluded from this.

However, after light has gained such great importance for practical medicine over the past 10 years, interest in its biological effects has of course increased significantly. Efficient work has appeared in some areas in recent years, and through the introduction of strong, concentrated light for experiments, it has often been possible to obtain clear and definite results where previously only dubious ones were obtained; through this our knowledge is many

1) EDWARD, De l'influence des agents physiques sur la vie, Paris 1824. Light effects have become clearer and more reliable than before. But there is still no reliable representation of what is generally known in this field. There are several reviews, but the authors -- presumably aware of the difficulty of giving a critical account -- have written them largely in the form of collections of material, mixing up the useful and the useless, leaving it up to the reader to find what is reliable and reliable which is unreliable.

I have therefore often felt the lack of a sober and not too uncritically collected presentation of the biological effects of light; but I didn't have time to do the work myself. It was my intention, however, now, in association with my assistant Dr. Busck to begin with; but since I soon realized that it would be too great and strenuous work for me, I consulted Dr. BUSCK arranges for her to take over alone; however, I shall constantly follow his work and take an indirect interest in it. Undoubtedly it is very difficult work, but, as I said, it is necessary to get it done.

The preliminary plan is to give a presentation that not only consists of a critical treatment of the literature, but is also based as far as possible on independent investigations - partly on investigations that have already been made here in the laboratory and which I know personally, partly those which Dr. Busck will carry out himself or which can be carried out in the laboratory little by little as the work progresses. Here I am only thinking of such smaller, controlling and orienting investigations that can be carried out without a disproportionately large expenditure of time.

Niels R Finsen.

introduction

The light and its composition.

In the following, the word "light" includes all radiant energy emitted by glowing bodies, not only the relatively small number of rays, which enable us to recognize the objects around us, but also a large number of invisible rays, the presence of which can be proved, and whose energy can be measured by the changes they can produce in the bodies by which they are absorbed ɔ: in which they are transformed into other forms of energy.

to

It is well known that light moves in straight lines within the same homogeneous substance, while the direction of movement can be changed by reflection or refraction in passing from one body to another.

The reflection can be irregular (from rough surfaces) or regular (from smooth surfaces). In regular reflection, the reflected ray lies in the same plane as the incident ray and the normal of incidence; In addition, the angles of incidence and reflection are the same. Similar laws apply to the refraction of rays:

the refracted ray lies in the plane with the incident ray and the normal of incidence, and the relationship between the sine to the angle of incidence and the sine to

Eg

Refraction angle is constant for refraction between the same two bodies. If the direction of the rays is perpendicular to the surface of a body, there is no refraction; if a ray passes through a transparent body with parallel faces, the directions of the ray will be parallel before and after the passage.

The rays emitted by a light source often have different refractive powers.

If parallel rays of the sun, which penetrate through a narrow slit into a dark room, are allowed to fall on a glass prism whose refracting edge is parallel to the slit, these rays will be refracted unevenly, so that they will be caught on a screen show as a luminous band of great extent. This band is colored differently: at the refracting edge of the prism it is red first, then orange, yellow, green, blue, indigo and finally furthest away from the refracting edge - i.e. most strongly refracted: violet. This is the visible part of the solar spectrum; but on both sides of it the screen is struck by invisible rays--the ultra-red and the ultra-violet rays

will. Of the complete solar spectrum, the ultra-red part is by far the largest, while the visible and ultra-violet parts are roughly equal in extent.

Light propagates through “empty space” at a speed of around 300,000 km. in the second. Motion is by transverse wave oscillations in aether. The wavelength and number of oscillations per second is different for the different rays in the spectrum, so that the least refractory, the ultra-red rays, have the largest wavelength and fewest number of oscillations, while

the most refractory ones, the ultra-violet ones, have the smallest wavelength and the highest number of vibrations. The product of the wavelength and the number of oscillations is constant for all types of radiation.

The table above shows the approximate extent of the solar spectrum as observed or measured on the surface of the earth. However, the limits vary greatly due to absorption in the earth's atmosphere. In recent years, even ultra-red rays with a wavelength of up to 61,000 uu have been observed from artificial light sources, while in the spectrum of electric sparks between metal tips it has been possible to photograph lines with a wavelength as small as 100 yu.

The numbers mentioned show how relatively few rays we are able to perceive with our eyes, and how small a part of the entire spectrum the individual spectral color represents.

While the quality of the light is determined by the wavelength of the rays, its intensity depends on the wave height of the rays, with light intensity increasing as the square of the wave height.

Rays with a wavelength between approx. 350 uu and approx. 800 uu are visible ɔ: they are able to penetrate through the refractive media of our eyes and specifically influence the retina cells. However , the transition between the visible part and the invisible parts of the spectrum is not sharp, and the boundary is somewhat different for different individuals.

The ultra-violet rays are absorbed in the cornea and lens and for this reason alone cannot be seen. According to WIDMARK, people who have undergone cataract surgery are 1). able to perceive more short-wave rays than people with normal eyes, because part of the ultra-violet rays, which are otherwise absorbed in the lens, reach their retina. The ultra-red rays are also mostly absorbed in the refracting media of the eye, and the few (about 10%) that do penetrate are unable to specifically affect retinal cells.

The existence of the invisible rays can be proved by the changes which they produce, like the visible rays, in the bodies in which they are absorbed. The ultra-red rays are most easily detected by their thermal properties, while the ultra-violet ones are more clearly manifested by their chemical effects. (See Fig. 1.)

The former, however, also have chemical properties; it is Z. B. possible to achieve an effect of the same on particularly suitable photographic plates. On the other hand, the so-called "cold" ultra-violet rays can also be converted into heat

1) Scandinavian. Archives of Physiology 1892.

and the visible rays are known to possess both thermal and chemical properties.

As mentioned, the light propagates through wave movements in the ether. These vibrations are generally in all directions in a plane perpendicular to the direction of the beam. In various ways it is possible to allow the vibrations to proceed in only one direction, so that they all lie in the same plane; the cross section of the

ultra red.

Red Yellow. Blue. Violet.) Ultra-violet.

Fig. 1. A. Schematic curve for the distribution of the heat effect in the sun

spectrum, B

effect on retina. C

silver chloride.

A line will then emanate and the light is said to be plane or polarized. A number of bodies (e.g. a glucose solution) have the property of rotating the plane of polarization around the axis of the beam when the polarized light passes through them. The direction of torsion can be different, and the body is referred to as resp. right or left turning.

A polarized beam of a certain wavelength is the most elementary component of light, the simplest form of light energy.

HERTZ) proved that when electricity discharges as a spark between two spheres, aether waves produce electric rays. It has been found that radiant electricity travels at the same speed as light and is subject to the same laws of refraction and reflection as light. It is absorbed by electrical conductors while passing through wood, glass and other insulating bodies. It propagates by means of ether vibrations, the direction of which is perpendicular to the direction of the rays.

This and many other consistent conditions indicate that the light must be understood as an electro-magnetic wave movement. The wavelength of electric rays is, however, much larger than that of light rays, while the number of oscillations per second is many times smaller.

When telegraphing without a wire z. B. electric beams with a wavelength of more than 100 m. In the system, therefore, one must imagine the electric rays to be well outside the extreme ultra-red part of the spectrum.

Wavewidth vibration number

in millimeters per second Radiant electricity

100 000.0

3 million

50.0 Extreme measured ultra-red rays

0.06 1 000 5 trillion red.

0.000 667

450 violet

0.000 411 730 Extreme ultra-violet rays measured

0.000 100 3 000

6 000

A spectrum is displayed either by refraction of the light in a prism or by allowing the light to fall on a so-called grating *). That

1) HERTZ, investigations into the propagation of electric force. *) RowLand's concave grid is the most commonly used.

the latter is based on the fact that light is refracted as it passes through a narrow slit, and consists of a plate of glass or a plate of mirror. metal into which numerous fine, parallel lines are machined

up to a few thousand on every inch -- are scratched. If white light is directed against the grating, the spectrum is formed from the transmitted or reflected rays. In the prism, the rays are refracted according to a different law than in the lattice. In this latter they are deflected in proportion to the wavelength, so that the lines in a grating spectrum are spaced from one another which is proportional to the wavelengths of the rays; the grating spectrum is therefore called the normal one. On the other hand, after refraction in the prisms, the rays diverge more strongly the smaller their wavelength is. The prism spectrum becomes less complete than the grating spectrum because of the absorption in the prism. A glass prism absorbs z. B. both a very large part of the ultraviolet and the ultra-red rays. Rock salt allows more ultra-red rays to pass through, rock crystal more ultra-violet rays.

Because rock crystal is birefringent, in order to obtain just a single spectrum, prisms of this material must be cut in a certain way in relation to the crystal axis.

A light source that emits rays of any wavelength will give a completely continuous spectrum. Such a spectrum is given by the light of incandescent bodies in solid and fluid form, e.g. B. DRUMONDS lime light. Glowing types of air, on the other hand, only emit rays with very specific numbers of oscillations and as a result they produce discontinuous spectra (line or band spectra). Vapors and species of air also have the property of absorbing rays of the same refractivity as they emit when incandescent, while allowing all other rays to pass through. The consequence of this is that the light of an incandescent solid and liquid body, after passing through a certain kind of air, will give a spectrum with dark bands (absorption lines), which correspond to straight rays of the refracbility which the air in question emits when incandescent. The solar spectrum can be cited as a typical example of such a spectrum. In this there are a large number of dark lines (FRAUENHOFER lines), the most important of which are marked with the letters of the alphabet: A, B and C in red, double line D at the beginning of yellow, E in green, F between green and blue , G in the Indigo and Him violet. Since these lines, which can be traced back to absorption in the sun's and earth's atmosphere, always lie in the same place, since they correspond to rays of quite definite wavelengths, they are used to describe definite points in the spectrum. to draw. Also in the ultra-red as well as in the ultra-violet part of the solar spectrum there are numerous lines corresponding to the FRAUENHOFER lines in the visible spectrum.

As mentioned, the rays of light are reflected from the surface of a body either regularly or irregularly, depending on whether the surface is smooth or rough. It is similar with the rays which pass through a body; they can leave it either regularly ordered following the laws for regular breaking or distributed. The first happens e.g. B. when the rays pass through an ordinary glass plate. If, on the other hand, the glass plate is opaque, every point of the same will emit rays in all directions; in other words, the plate functions as a new light generator.

Fig. 2. Fraunhofer lines in the solar spectrum ').

I) According to PAULSEN.

2) According to HERMANN. (The blue-violet rays are also absorbed by hemoglobin; this is not indicated in Figs. 3 and 4.)

We know of no substance that is penetrable by all rays of the spectrum; even the most easily penetrated will always absorb some rays.

On the other hand, there is no body completely impenetrable to light; some rays of the spectrum will always be able to pass through sufficiently thin layers.

The color of a body depends on its absorption of the visible rays of the spectrum. Does he suck z. B. all except the red rays, there these become

whether they are reflected or whether they pass through impressing on our retinas, make us believe that the body in question is red

and so on. A body is white when the visible rays are reflected to the same degree; it is uncolored when all these rays pass through it, and black when all rays are absorbed. To produce white light, however, it is not necessary to combine all visible rays; the optical mixing of two complementary colors is sufficient for this.

If you put two different colored glass plates, e.g. For example, a red and a green together will be approximately opaque; the red absorbs most of the rays that pass through the green and vice versa. When two colored liquids are mixed, they also absorb all the light that they would block each other.

conversion of light energy.

As already mentioned, energy conversion will always take place when light rays are absorbed in a body. On the other hand, the body is only influenced by the rays which it absorbs, while the rays which pass through or are reflected by the body cannot cause any changes in the same. - Whether a certain type of radiation is converted into thermal, chemical or another form of energy in a given case depends exclusively on the nature of the absorbing body, and conversely one and the same body is influenced in different ways - or at least unequally strongly by the different spectral rays will. It can also happen that rays of different refractivity cancel their mutual effects at certain points.

In the following I discuss the most common forms into which light energy can be converted:

The heat effect of the light can, for. B. can be detected by means of a thermometer with a blackened container. It was previously assumed that the maximum for the heat effect of the solar spectrum was in the ultra-red part. However, LANGLEY demonstrated its location in the red-yellow part of the visible spectrum. The curve for the effect of heat falls sharply on both sides, and the ultra-violet as well as the extreme ultra-red rays represent so little heat energy that instruments more sensitive than the thermometer must be used to detect them*). - (See p. 23 about this).

The heat generated by the absorption of light rays in a body can either be dissipated or re-radiated in the form of long-wave rays. The chemical effects of light. The effect of light on the so-called "light-sensitive" bodies depends on the chemical composition of these bodies. Under the molecular rearrangements or changes caused by light, energy is bound in some cases and released in others.

*) It is interesting to observe how the different rays are also perceived retina-cerebral as warm or cold. One speaks of warm (red-yellow) colors in a painting, of the cool (blue-violet) tone in a landscape, etc

As is the case with chemical "catalysts," light often seems to act only to facilitate the course of a chemical reaction, that is, to reduce resistance to it, and it is here that the explanation for the apparent imbalance must be sought, which is so frequently observed between the minimal thermal energy and the intense chemical action of the highly refractory rays.

Sometimes no visible change occurs in the photosensitive body during exposure, but it is rendered more susceptible to later chemical action to which it would have responded more difficult before exposure. We have a well-known example of this latter relationship in the photographic plate, which during development is only affected at the points which have been exposed to light.

Rays which are not absorbed by the light-sensitive body are unable to act upon it; however, the body can be made sensitive to such rays by adding a substance that absorbs them (VOGEL)). By means of such so-called optical sensitizers, color-sensitive photographic plates are produced which, in contrast to the usual ones, are also affected by yellow and red light. How to explain the sensitization is not known exactly; it is possible that fluorescence phenomena play a role here.

1) VOGEL, Handbook of Photography. 1890

Chemical sensitizers are to be understood as such added substances which, by chemically binding the substances released during exposure to light (bromine, iodine, oxygen, etc.), help to strengthen them.

As a rule, the chemical effects of light are so weak, or so slow, that it is impossible by ordinary analysis to show what they actually consist of. However, sometimes the opposite can also be the case; e.g. For example, a mixture of chlorine and hydrogen changes to hydrochloric acid in the light, and this process often occurs explosively in direct sunlight. Quinine sulphate turns yellow under the influence of highly refractive rays, in that a conversion to quinidine takes place with the absorption of water. Yellow phosphorus is converted to the amorphous red form in the light, etc

While the photochemical action on several silver salts is based on a reduction which liberates silver, exposure of organic bodies to light often results in oxidation. Bilirubin is z. B. Transformed to biliverdin in the light; Olive oil oxidizes very quickly when exposed to light, and the well-known 'bleaching' which most colors which are not protected from light undergo may also be due to an oxidizing process. In concentrated electric light, such a bleaching of dyes can take place within a few minutes.

The blackening of the silver halides caused by the light goes under chlorine resp. Elimination of bromine occurs, and the product can again be bleached in the dark by the action of the halide in question. LUTHER 1) showed that the blackening of silver chloride in the light of NML KH

G

FED CBA

Fig. 6. 1. Paper with silver nitrate (copied). 2. Iodide silver with excess silver nitrate on paper (copied). 3. Silver iodide with silver nitrate bath, wet collodion process with acid ferric vitriol development. - 4. Bromide of silver with excess silver nitrate on paper (copied). 5. Chloride of silver and silver nitrate on paper (copied). 6. Chloride of silver, which turned violet in the light (formation of photochloride) and was only then exposed to the spectrum. 7. Iodobromine collodion in the wet collodion process with acid iron vitriol development.

8. Bromosilver containing eosin silver with silver nitrate in wet collodion ve:fabren with acid iron vitriol development. 9. Eosine-containing bromide of silver in

of the gelatine emulsion with alkaline pyro developer.

I) Journal of Physical Chemistry, 1899, Vol. XXX, p. 628

ceases at a definite point when the silver chloride is surrounded by an aqueous solution of chlorine; the degree of blackening depends both on the intensity of the light and on the chlorine tension, and these two factors are thus kept in equilibrium to a certain extent.

In order to illustrate how great a difference there can be in the effect of the individual spectral sections on different preparations of chlorine, bromine and iodine salts, the adjacent curves taken from EDER "The Chemical Effects of Light" are added (Fig. 6).

As an example of the antagonistic effects of two types of rays it may be mentioned that guaiac resin is colored blue by the strongly refractory rays, while it is decolored again by the less refractory ones. In a similar manner red light hastens the oxidation of iron vitriol, which proceeds slowly in the dark, while violet light inhibits it.

The crystalline form of selenium, which is electrically conductive, has the peculiar property of conducting electricity better in the light than in the dark. If a thin plate of selenium is connected to an electric current connected to a telephone and exposed to light intermittently, a tone will be audible in the telephone. BELL used this circumstance to construct his "photophone". By means of this apparatus it is possible to carry on a conversation with a distant person, the rays of light forming the connection between the speakers, in a similar way to the electric current in the telephone.

Different bodies, e.g. B. thin ebonite and ivory plates, paper, etc. can be made to sound by intermittent exposure (radiophony). Notices a. Finsens Medical Light Institute. viii

The light can be converted into other forms of energy than those mentioned: Electric currents can be generated by means of the light and guaiac resin and flux path crystals are charged with electricity when exposed to light. On the other hand, a body charged with negative electricity emits its charge to the surroundings upon exposure to ultraviolet rays.

A steel needle becomes magnetic if one half is exposed to light for a long time while the other half is kept in the dark.

The mechanical effect of light. Various crystals decay pulverized in the light, even when stored in fused glass tubes; Ebonite expands under the influence of light, and since blue light acts more strongly than red light, it cannot be all about the effect of heat.

In the so-called "light mill" a direct conversion of the light rays into kinetic energy takes place. The light mill consists of an evacuated glass balloon; A small horizontal cross made of metal wire is attached to it, which can rotate around a vertical axis. Small plates, black on one side and white on the other, sit on the tips of the metal wires. When the apparatus is exposed to light, the black areas are repelled and the cross begins to rotate. In this case, the heat rays are the most powerful.

The light can communicate to different bodies the property of condensing vapors (camphor and water vapours, for example). Covering a polished glass or metal plate with a perforated screen and exposing it to sunlight for a time will not alter the appearance of the plate; if you breathe on the plate,

in this way a sharp image of the screen emerges, in that the exposed parts are fogged up.

Fluorescence. Finally, light beams of one wavelength can be converted into beams of another wavelength. Invisible ultra-violet rays can e.g. B. be changed to visible by falling on certain so-called fluorescent bodies. Fluorocalcium, a solution of acid sulphate of quinine, petroleum, eosin, &c., are well-known examples of such bodies. An ethereal solution of leaf green (chlorophyll) is a beautiful green when viewed in transmitted light, while the reflected rays are intense red. The fluorescence phenomenon is always caused by the same rays preferentially absorbed by the fluorescent body. According to STOKES, the light rays in fluorescence always change in such a way that their wavelength becomes larger than before. As a result of LOMMEL, on the other hand, there are also fluorescent bodies that can change the wavelength of the light rays in the opposite direction.

Phosphorescence is a somewhat similar phenomenon. It consists in the fact that individual bodies, after being exposed to rays of high refractivity, continue to emit rays of less refractive power for some time after exposure. The phosphorescence is increased when the body is heated, but at the same time the duration of the phosphorescence is shortened.

A number of other phenomena are also, and with more justification from the etymological point of view, called phosphorescence. So many chemical processes accompanied by the development of light, although they take place without any recognizable increase in temperature (chemical luminescence).

The slow oxidation of phosphorus, which causes it to glow in the dark, is a well-known example of this kind. Rotting organic substances that glow in the dark and glowing insects or microorganisms (bog lights) are also to be mentioned in connection with this.

light measurement.

1. Qualitative light measurement consists of examining which rays of light a given light contains and which are absent.

(a) The visible rays are most easily examined by means of a spectroscope, an apparatus which in its simplest form consists of binoculars, through which one observes the rays refracted by a prism. It can be directly examined by means of a spectroscope which of the visible rays are present and which are not.

b) The presence of the ultra-red rays is ascertained after refracting the light by a rock-salt prism or a Rowlands grating and observing whether beyond the red part of the spectrum it acts on a thermometer, a thermopile, or a bolometer. (However, it should be remembered that in the ordinary Rowland grating several partially overlapping spectra are formed.) These rays can also be isolated by filtering the light under investigation through a solution of iodine in carbon disulfide. This solution, in sufficient concentration, stops all the others except the ultra-red rays.

c) Ultra-violet rays are detected by refraction of light through a rock crystal prism. If ultra-violet rays are present, then achieved

you z. B. Effect on silver chloride paper when placed outside the blue-violet end of the spectrum. However, their presence can also be ascertained without isolation. In fact, the highly refractory rays, in contrast to the less refractory ones, are distinguished by the fact that they make the air they penetrate conductive to electricity; if you set them up e.g. B. against an electroscope charged with negative electricity, the gold leaves of it collapse. It is even easier to use ABSALON LARSEN's) "actinoscope", the design of which is based on the fact that the formation of induction sparks between two electrodes is promoted by exposure of the negative electrode to ultraviolet rays.

The most accurate qualitative investigation, both of the invisible and the visible rays, is made by refracting the light in a Rowland concave grating and photographing the spectrum formed.

2. Quantitative light measurement. In general, the energy of a source of power is usually measured by the work which it can do in a definite time; it is expressed in kilometers per second. A similar measure might be applicable to the amount of energy emitted by a light source. You could e.g. B. using a bolometer to try to convert the light energy emitted in a certain period of time into heat, measure the amount of heat developed and thus express this in turn in kilograms per second. First of all, it has not been proven that all light energy is converted into heat by absorption in a blackened metal plate

may arise e.g. B. electric currents, the formation of which also requires a certain amount of energy - and secondly, such an expression for the total energy of a light transmitter is of little or no importance in biological investigations. Because the fact that a light source represents so and so many kilograms per second does not give us the slightest information about the biological effect of the light source in question. The highly refractory rays, which represent such great biological value, are "cold" and the thermal energy into which they can be converted is negligible compared to that contained in the less refractory rays, which are often less effective from a biological point of view.

In other words, we are unable to express in a single number the biological value of a light giver. We need a whole series of numbers -- one for each of the properties that are of interest to us in the particular case.

Things are quite different with rays of definite refractivity (e.g. monochromatic light). In this case a number suffices, no matter whether this is an expression of the thermal, chemical, or mechanical energy of the type of radiation in question, or of the strength of its effect on our retina.

From the above it will appear the impossibility of a quantitative comparison between two kinds of rays of different refractive power -- a comparison which in one sum encompasses all the properties of the rays with our present knowledge of light. What we are able to measure quantitatively and compare with it are the individual properties of the various light sources, each taken separately: their heat capacity, their luminosity, their bactericidal activity, their effect on silver salts or on other chemical reagents, etc

These relationships cannot be emphasized enough, since experience shows that erroneous results within experimental light biology are so predominantly due to erroneous quantitative comparisons between different refractive lights.

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1) Notifications from Finsens med. Lichtinstitut, Issue II, 1901, p. 108

The properties of light, the quantitative value of which is often used as a measure of the strength of a light source, are as follows:

1. The effect of heat. This is most easily measured with the help of a thermometer with a dull, blackened case; for more detailed investigations the thermopile or bolometer is used. The principle of the thermopile is the generation of an electric current when the soldering points of two different metals are heated unevenly. The bolometer (LANGLEY) uses the fact that the electrical resistance in a metal wire increases as the wire heats up. Both apparatuses are connected to a galvanometer during use, and the amount of heat supplied is calculated from the magnitude of the deflection of the galvanometer needle.

The principle of heat measurement, whether it is done by means of a blackened thermometer, thermocouple or bolometer, consists in such a strong heating of the black surface concerned by the rays above the temperature of the surroundings that an equilibrium is established between the heat supplied and the heat given off. When measuring the absolute thermal energy of the rays, it is necessary to make calorimetric determinations.

2. The effect on our retina. In order to be able to express the so-called “optical light intensity of a light source in numbers, lamps or candles (“Xormal candles”) of different types are constructed and these are used as light units. The most common one is now the HEFNER lamp!) -- an amyl acetate lamp with a burner diameter of 8 mm. and their flame height 4 cm. amounts to. The light transmitter to be examined is now compared with a second one using a so-called photometer, the optical light intensity of which is predetermined

e.g. B. in relation to the Hefner lamp, and one arrives in this way in sound to be able to express the strength of the examined light in so many light units.

A number of different photometers have been constructed, of which RUMFORDS, RITCHIES, BOUGUERS, BUNSENS, and LUMMER-BRODHUNS are most commonly used. The latter two give the most accurate results.

RUMFORD'S photometer consists of a white screen, in front of which is placed an opaque rod. In front of this rod, the two light sources are placed so that the shadows that the rod will cast on the screen are close together. Now move one of the light sources closer or further away until the shadows appear to be evenly dark, and the strength of the two light sources will then be related as the square of their distances from the screen.

If the formation of a quick and only approximate concept of the relationship between the optical value of two lamps is sufficient, a similar principle can be followed by improvising the rod and shade using a pencil and a piece of white paper. These are led around the lamps to a point where the two shadows cast on the paper by the pencil appear to be the same

1) The HEFNER lamp is also sometimes used as a chemical unit for light.

are moderate, and then measure the distance of this point from the lamps.

In RITCHIE's photometer, two pieces of white paper, placed obliquely and at the same inclination in a square tube, are illuminated, each with its own illuminator. You observe them through a tube placed just above the point of contact between the two pieces of paper and then move one of the light sources until the pieces of paper appear to be evenly illuminated.

In BUNSENS photometers, use is made of the fact that a grease spot on a piece of white paper appears dark in incident light, but bright in transmitted light, while it can be made to disappear by simultaneous illumination from both sides. It is necessary to take two measurements, first looking at the paper from one side and then looking at it from the other side. The luminous intensity can then be calculated from the central distance between the lamps.

These photometric methods are variously varied and improved upon by others; but, for reasons of space, I must refer to optical manuals for a description of them.

3. Chemical Effects. The devices used to measure the chemical intensity of light are called actinometers or chemical photometers. However, as discussed earlier (see page 17), the effect of one light source on one chemical reagent does not imply its effect on another, and the fact that two light sources e.g. B. affecting silver chloride paper to the same extent in the same periods of time does not entitle us to identify them.

In Bunsen and Roscoe's Actinometer a mixture of chlorine and hydrogen is used, which, under the action of light, forms hydrochloric acid; the reduction in volume over a certain period of time gives the measure of the light intensity.

BECQUEREL's electro-chemical photometer consists of two silver plates coated with a layer of silver bromine or silver iodine. The plates are lowered into a jar of dilute acid and connected to a galvanometer. If one plate is illuminated while the other is kept in the dark, the cleavage of the silver bromide produces an electric current whose strength depends on the intensity of the illumination, which can therefore be measured by the deflection of the galvanometer needle.

Vogel's scale photometer consists of a small, oblong wooden box into which a strip of paper dipped in a solution of potassium bichromate is placed. The paper is exposed through the glass lid of the box. On this are strips of tissue paper glued one on top of the other in such a way as to form a series of sections of evenly increasing radiation; each of these sections is denoted by a black number. During exposure, the yellow paper turns brown and the color change progresses from the thinnest end of the scale to the thickest. The numbers will show up brightly on a dark background and the last visible one indicates how far the light effect has gotten. Silver chloride paper can also be used instead of chromate paper. (STEENSTRUPS light meter).

For use in examining very strong light (e.g. concentrated electric light), ABSALON

LARSEN constructed an actinometer in which the light is attenuated by passing through a thin layer of finely powdered rock crystal. The application of the rock crystal causes an approximately equal attenuation of the visible and ultra-violet rays. Silver chloride paper is used as the sensitometer, and its degree of blackening is again determined by means of a modified LUMMER-BRODHUNS photometer.

A large number of other chemical photometers have also been constructed, chiefly for the use of photographers, in which silver salts are most commonly used as sensitometers, but it would lead too far to go into a detailed description of them here.

4. The mechanical power of light, measured by the "light mill" discussed earlier, has also been used as an expression of light intensity. It was either calculated according to the speed of rotation, or the wings were hung on a thread, which ensures that they do not rotate but only make a deflection, the size of which depends on the strength of the light.

5. Biological Effects. Several of the effects of light on living organisms have proved to be so constant and regular that they can often be used as a measure of the intensity of light in biological investigations. The errors caused by the individual differences in living organisms are in many cases neutralized by the advantages offered by the method. The measurement of light by its effect on our retina has already been discussed, and I will mention only a few more examples.

a) The bactericidal power of light given by the time required to sterilize an agar-agar surface placed at a certain distance from the light source at right angles to the direction of the light (FINSEN). Bac. prodigiosus is particularly well suited for use in such measurements, partly because it grows quickly and safely on agar-agar, partly because the red color of the colonies makes it easier to spot. One uses e.g. B. a 24-hour-old broth culture, filter through glass wool or filter paper to avoid lumps and spread in a thin layer onto agar-agar surfaces using a sterile brush or platinum loop. Since the resistance to the effects of light varies somewhat with the age of the culture, this must always be taken into account. After exposure, the cultures are placed in the thermostat under favorable humidity conditions for 1 or 2 days.

A major drawback associated with these measurements is that individual bacteria in such a culture are able to survive exposure that kills the others. The cause has not yet been elucidated, and this circumstance has the consequence that, instead of absolute killing, one has to content oneself with demanding such a strong dilution that only individual, well-separated colonies develop. - The use of infusoria is also possible; these offer the advantage that, immediately after exposure, one can observe under the microscope whether or not killing has taken place.

b) The ability of light to cause vasodilatation in the skin can also be used

FINSEN). The light intensity is given by the time it takes for the rays at a certain distance from the light source to reach a red spot that is just visible, e.g. B. on the volar surface of the forearm call. By placing a piece of paper on the skin, in which a small star-shaped hole has been cut, it becomes possible to make the exposed spot small and at the same time sharply delimited from the surrounding skin. This procedure gives room for too many exposures and the reactions become more obvious. It should be remembered, however, that the thickness of the epidermis and the pigmentation of the skin play a major role in the exposure time required for the reaction to occur, and one should therefore only compare measurements carried out simultaneously and on similar areas of the skin.

Since both the bactericidal and the vasodilating properties of light are linked to a particularly high degree to the strongly refractory rays, the last-mentioned methods determine the quantity of these rays in particular.

Various light sources.

If more heat is supplied to a body (e.g. a piece of metal) than it can give off in the same period of time, the temperature of the body rises. If one continues to supply heat, a part is converted into light energy; in other words, the body begins to emit rays of light, at first only invisible ultra-red rays, but gradually as its temperature rises it emits more and more short-wave rays; at about 5250 it becomes red hot and ends up being an incandescent emitting both ultra-red and visible as well as ultra-violet rays.

Species of air, even heated to very high temperatures, do not become visible.

It is a general rule for solid and liquid light sources that the maximum intensity of their rays is shifted towards the ultra-violet end of the spectrum as the temperature rises. The displacement is so regular that the wavelength, which corresponds to the maximum intensity of the rays, multiplied by the absolute temperature of the light source, is constant.

On the other hand, we know of no such regular relationships for light sources in the form of air or vapor. The flame in an ordinary Bunsen burner is as good as non-luminous: despite the fairly high temperature, it only emits heat rays. Only when one or another solid body glows in the flame do shorter-wavelength, visible rays appear.

the sunlight. The intensity of sunlight varies with the geographical location of the place and its height above sea level, with the seasons and times of the day, and finally with the water content of the air, due to absorption in the earth's atmosphere. In other words, it depends on the height of the sun, the barometric reading and the degree of humidity in the air. The greater and denser the layer of air through which the rays must pass before they reach us, and the higher the degree of humidity in the air, the more the light will be weakened. Of course, the purity and clarity of the air or its contamination with dust, coal smoke or the like also play a role.

Simultaneously with the weakening of the total intensity through the absorption in the air, the sunlight is also subjected to a qualitative change through an unequally strong absorption of the different types of radiation. The long-wave rays penetrate the air much more easily than the short-wave ones, and as the sunlight passes through the earth's atmosphere, there is a shift in the maximum intensity towards the red part of the spectrum, a shift which becomes more pronounced the greater the distance from the rays passing layer of air is. In other words, sunlight contains relatively more heat rays and fewer chemical rays when the sun is low in the sky than when it is high in the sky. In this circumstance we must seek the cause of the fact that the sun appears white when it is high in the sky, while to us it appears redder and redder as it nears the horizon. If we could observe it from a place outside the earth's atmosphere, it would appear bluish to us because of the large amount of short-wave radiation which, as a result of its enormously high temperature, it must by all assumptions emit. The air absorption of these rays is so strong that the sunlight on the surface of the earth becomes relatively poorer in ultraviolet rays than e.g. B. the electric arc light.

The difference in intensity and quality between the sunlight in the lowlands and in the high mountains is due not only to the difference in the layers of air through which light passes in the two cases, but also to the fact that absorption is stronger in the lowest, and therefore densest, layers of air is, than in the uppermost, less dense.

The following two tables calculated by lecturer ABSALON LARSEN 1) show how the intensity and quality of sunlight vary at our latitude according to the season and time of day:

1) Notifications from Finsens med. Light Institute Issue I. 1900.

prem.

time

afternoon

21st December
January 20th
19th of February
March 21st.
April 21
May 21st
June 21st
21 July
August 21st
September 22nd
October 22nd
21st November
21st December

118.9 11496 100,

38.7
34.9

236 72.3

58.3 100,

ȷ 9736 114.6 112.1

1040 116.5 : 10930 112.1

971 7 2.3

68.4 58,

349 12.7

9.9 40

18

2, 49.! 23.1 893 i 49., ' 44.7 76,

52.6

447 49

23.1 398

2.1 1.7

89-3

53 2

07

1040 8799

71,

18.2

38,

10.3

2396

2.5

1

2.5

Since the numbers in the two tables do not express the same units, they cannot be compared directly, but the relationship between the variations in the numbers shows us how much faster the chemical intensity than the heat intensity of sunlight decreases.

The electric arc light. (DC lamps). The electrodes are made of carbon, a thicker positive and a thinner negative. In order to achieve regular cratering, the carbons are often manufactured in such a way that there is a hard layer on the outside and a soft "core" on the inside. The temperature in the arc is estimated at around 4000°. The quantity and quality of the light emitted is depends on several different factors, of which I will discuss the most important ones below.

The importance of amperage will appear from the following table of approximate maximum luminous intensity of DC arc lamps.

amperes.

hefner units,

ok

20

1 480
4 000 According to UPPENHORN: Calendar for electrical engineering
7 200

niker.

30 40

II 000

15 OCO

50 60

18 000

22 000

70 08

Found by approximate

calculation

26 000

90

by Docent ABS. LARSEN.

100

30 000

33 000

37 000

Determined by trials on

Finsens med. light institute.

From the table it can be seen that for currents above 20 amperes the light intensity increases fairly constantly with 3 to 4000 light units for every 10 amperes. the

3 Notices a. Finsens Medical Light Institute. vii

3

Incidentally, luminous intensity depends to a significant degree on the nature of the charcoal used, so that the figures in the table can only be regarded as practical average values.

The light intensity also depends on the thickness of the charcoal. The charcoal generally used for lighting purposes does not give the greatest useful power, as the caliber is chosen to be fairly thick, in order that an assortment of charcoals should last a long time. Choosing thinner coals will give you a stronger light, but the coals will also be consumed faster.

Most of the rays come from the crater in the positive carbon, and because of the mutual position of the carbons in the ordinary arc lamp, the strongest light, as will be seen in the following drawing*), will slant down at an angle of about 50° to the common axis of the coal to be sent.

it

item coal.

18,000H (79°)

Neg. Money.

0 21,000H (45°)

27 000 H. (489)

37000 H. (500) Fig. 7. DC carbon arc lamp: 110 Amp. - H - Hefner units.

*) The measurements are based on FINSENS med. Light Institute executed by Docent LARSEN.

In experiments with Bac. prodigiosus it has been proven that not only the optically effective rays, but also the strongest bactericidal rays are emitted primarily by the carbon tips (especially the positive ones) and to only a lesser extent by the bow (FINSEN).

By placing the carbons in the so-called projection position, it can be avoided that the negative carbon tip shadows the rays emitted by the positive crater. This achieves the attainment of a stronger light in a certain direction.

The AC lamps give on the whole the same light as the direct current lamps; but because the electrodes are heated in the same way, the light is emitted more evenly in all directions and is therefore more widely distributed.

In the Bremer lamp, by adding various lime salts to the carbon, a significantly greater luminous intensity is obtained at the same current than in the ordinary arc lamps. The light has a yellowish glow.

The Jandus Lamp and the Regina Arc Lamps. In these lamps, the charcoal tips are placed in a closed space, so that the free supply of oxygen in the air is prevented. This avoids the formation of a pronounced crater and, moreover, the coals are consumed very slowly. The arc becomes very long, and from this the greater part of the light, which is rich in short-wave rays, is emitted. The lamps burn with greater voltage than ordinary arc lamps.

By using electrodes made of metals instead of carbon, or by adding metals to the carbon, the light becomes richer in highly refractable rays, while there is also a plus here: the rays of the glowing metal vapours. This

give band or line spectra on refraction, and the rays usually have a large number of oscillations. Of course, the light will vary with the type of metal and amount added. These relationships are the basis for the peculiar properties of the following lamps.

ARON'S mercury lamp. In this, the electrodes are formed by two mercury surfaces. The light emitted by the incandescent vapors of mercury is rich in ultra-violet rays; but as the vapors are kept confined in a small flask, this absorbs a large part of the most refractory rays.

In Bang's iron lamp, the electrodes consist of two small iron capsules that have been cooled by running water through them. The bulk of the rays are emitted by the arc between the electrodes and not by the electrodes themselves as is otherwise the case. Here, in the actual meaning of the word, we are talking about an "arc light" and this is particularly rich in ultra-violet rays in the lamp mentioned.

The dermo lamp is based on the same principle.

The light emitted by the latter lamps has characteristics similar to those produced by various electrical discharge phenomena, such as e.g. B. in the induction spark and the light of Geisler's tube. This light resulting in line or band spectra contains a large amount of ultraviolet rays and very few heat rays. STREBEL has designed various induction spark lamps in recent years.

The electric incandescent lamp emits very few highly refractable rays. The light intensity will change with the voltage of the current, among other things.

The Nernst lamp gives a much more intense light, and it has the great advantage that its intensity of light remains constant.

The properties of the gas flame and the acetylene flame are somewhat similar, only the temperature in the latter is slightly higher than in the former. Their luminosity is due to the glow of small particles of coal; on completion of combustion (Bunsen burner) the content of visible rays becomes minimal, but at the same time the temperature of the flame rises so much that a solid body placed in it becomes slightly incandescent (Auer's burner, Drummond's lime light).

Kerosene lamps, oil lamps, and stearin lamps emit only a few highly refractable rays.

ver

I want to briefly discuss some types of rays that have been known for a relatively short time, but which have attracted the greatest attention because of their peculiar properties. These are various invisible or barely visible rays 1) (cathode rays, X-rays, Becquerel rays), the presence of which can be demonstrated in the following ways:

1. By letting them fall on a fluorescent screen, from which they are reflected as visible rays.

2. Through their chemical effects, e.g. B. on a photographic plate. However, the rays can be

. not as the rays of light break in a lens and it is therefore only possible to obtain photographic shadow images.

3. By directing it towards an electroscope charged with negative electricity; the leaves of the electric

I) The Becquerel rays excite a fluorescence in the ocular media and can only be apprehended by this fluorescent light; however, the X-rays are directly visible in dark-adapted eyes.

skopes will collapse because the rays, like the ultra-violet ones, render the air through which they pass conductive to electricity.

4. Through their various biological effects.

The emission of the so-called cathode rays in an X-ray machine takes place from the negative pole (cathode). It is believed that particles are charged with electricity from the negative pole and are thrown away at a speed of about 4000 kilometers per second. The amount of electricity with which these particles are charged was calculated and found to be consistently the same regardless of the nature of the cathode. The rays are absorbed by glass, and only by special methods is it possible to get them outside the wall of the glass bulb. There is also a strong absorption of these rays by the atmospheric air, and they do not propagate in a straight line, but diffuse in a manner similar to that of light rays in opaque media. Another peculiarity of these rays is that they are affected by a magnetic field so that they are deflected when a magnetic pole is approached.

If a small metal plate is placed in the glass tube of the X-ray apparatus, it will itself emit rays of a completely different kind when it is struck by the cathode rays. These (X-rays or X-rays) can penetrate most bodies, but more difficult to penetrate through the heavy ones than through the light ones. X-rays are transformed by reflection from a body's surface, so that their penetrability becomes less, and this transformation is more pronounced the greater the specific gravity of the reflecting bodies.

Unlike cathode rays, X-rays cannot be influenced by a magnetic field. Like the rays of light, they are understood as ether oscillations.

becquerel rays. Some rare metals, the so-called "radioactive" substances, have the peculiar property of constantly emitting invisible rays.

These rays have so far only been little studied. Various circumstances, however, suggest that the rays emitted by radioactive bodies are of a similar nature to the cathode rays, and that, reflected from one body, they are changed to others having properties in common with the X-rays. If one blows the air surrounding a radioactive body over an electroscope, the leaves of the same collapse.

The most important radioactive substances are: radium, actinium, polonium, uranium and thorium; but the ability to emit Becquerel rays is not unique to these particular materials, as it also applies to other metals, e.g. B. platinum, can be converted.

Recent investigations even seem to indicate that all bodies can be made temporarily more or less strongly radioactive.

O ver the application of light in biological subjects

searches.

When it comes to investigating this or that biological effect caused by light, the first and most important question arises: "What light"? and "how strong light"? opposite. As developed in the preceding chapter, it is not possible, because of the qualitative difference in rays, to establish any common unit for light, as is the case with heat, mechanical energy and electric current. Therefore, the answers to the above questions can often be quite vague and never completely exact.

A. The type of light is best described by specifying the outer limit for the wavelength or number of oscillations of the rays. One can also use the place of the rays in relation to the visible spectrum and use it as resp. denote ultra-red, visible, or ultra-violet; each of these kinds of rays is thus again brought in different ways into subdivisions; the visible is of course divided into the seven main colors that have just been introduced, but the place of the rays in the spectrum can be determined more precisely by means of the "FRAUENHOFER lines".

The terms "heat rays" and "chemical rays" are used very frequently, respectively. used for long and short wave rays. These designations are misleading in that neither the thermal effect nor the chemical effect are tied to specific parts of the spectrum; however, they have proved their worth and may well be retained for reasons of linguistic convenience. The term actinic) rays is also used generically for the blue-violet and ultra-violet rays.

B. The intensity of the light can be measured either in units of light or by the magnitude of its effect on it or those well-known sensitometers, and as such one prefers to use the one on which the type of radiation in question exerts the strongest effect (see under quantitative light measurement, page 2 1 uf). If all rays of a light source are used, this and the entire experimental arrangement must be described in detail. With regard to sunlight, it will be necessary to state the geographical position of the place in question, as well as the date, time of day, degree of humidity in the air, etc. In the case of electric arc light, the current and voltage, the type of electrodes, their thickness and mutual position -- as well as the working distance (including possible concentration of the rays and the like) will be necessary information.

The light sources most frequently used in experimental light-biological investigations have been discussed above. If one wishes to work with certain spectral sections, one must obtain them as isolated as possible, which can be done in the following ways:

1. By using a light emitter, which preferably emits the desired rays; the other rays will then play no essential role in many experiments because of their comparatively low intensity.

2. By scattering the light through a prism and working in the desired spectral range. This method is the most accurate, but it has the inconvenience that you can only get very faint light.

If you want a pure spectrum, the rays to be refracted in the prism first have to pass through a narrow slit. If the gap is made too wide, the different spectral sections will overlap and partially cover each other. The intensity can be increased somewhat by collecting the rays to be used again using a lens.

3. Various types of filters can be used, which can only be passed by the rays for which one has application. However, one should never fail to examine one's filter spectroscopically in the light to be used in the experiment; because the absorption capacity of filters is not absolute: strong light can penetrate where weak light cannot. Be. . do you use e.g. B. VIERORDT-Krüss spectrophotometer, a quantitative determination can be made at the same time as to the degree to which the relevant spectral section is weakened by passing through the filter.

Colored glass is only exceptionally monochromatic. It is significantly better to use dye solutions in different concentrations. Such solutions are most conveniently mounted in small, flat, rectangular glass containers with ground plane-parallel sides. If one wishes to work with dry filters, glass plates can be used, as suggested by Raylaigh

, covered with different colored layers of gelatine or collodion.

I will briefly give some examples of the use of the above three methods.

Ultra Red Rays.

a) The radiant heat of a dull blackened piece kept heated to red heat is used

I) Nature, XXV, 1881.

metal The maximum intensity of the rays will shift towards the stronger refractable rays as the temperature of the metal increases.

b) By refraction z. B. sunlight or electric light through a rock salt prism or in a Rowlands lattice. Ultra-red rays of a certain wavelength can be produced in this way, but the intensity is only small.

c) By filtration of z. B. concentrated electric light by a solution of iodine in carbon disulphide, one can obtain ultra-red rays of very great intensity. The intensity maximum will correspond to the inner ultra-red rays.

The iodine solution must be just strong enough to prevent any visible rays from the light source used from penetrating. Since carbon disulfide vapors are highly irritating to the mucous membranes in the respiratory tract and since they are highly flammable, it is advisable to cover the surface with a layer of water. The two liquids will remain sharply separated for at least a time. The carbon disulfide can also boil when working with concentrated light, which can be prevented by pouring a steady stream of cold water over the glass container.

The water will certainly (like the glass) absorb part of the ultra-red rays, but only comparatively few in such a thin layer; if one wants to avoid this absorption, it is necessary to be content with trickling over the sides of the glass container.

visible rays.

If one wishes to isolate the visible rays, it is best to use the filtration method. The ultra red ones

Rays are blocked by letting the light pass through a not too thin layer of boiled, distilled water. In many cases it is sufficient to neutralize the effect of the heat rays by cooling the exposure object, e.g. B. by sprinkling it with a continuous stream of cold water. An overspray applied in this way is extraordinarily effective. Ultraviolet rays are removed by filtration through a fresh aqueous solution of quinine sulfuric acid (approx. 14/2%). Such a solution absorbs rays with a wavelength of about 412 uu and below. A solution of nickel sulphate absorbs a somewhat larger quantity of the violet rays.

When working with monochromatic light or with certain parts of the visible spectrum, one must either split the light through a prism or filter it through differently colored filters . Only a low intensity light can be obtained by using the first method, and the filtering method will therefore often be preferable.

In the past, colored glass plates were often used as filters. The best types are the ruby glass used in photographic darkrooms, which only allows the red rays to pass through, and the so-called "violet UV glass" (Schott and Gen., Jena), which holds back the red, yellow and green rays while the blue- violet and also very many ultra-violet penetrate. The other types of glass on the market are never nionochromatic and, moreover, vary so much that they are poorly suited to scientific use. One has therefore also more and more passed over to the use of colored liquids. The commonly used solutions are from:

(760 μμ

1. Fuchsin, which allows only red rays to pass through

656μμ). 2. Potassium bichromate: Red, orange and almost all yellow (760 uu – 540 uu).

μ μ) 3. Monochromatic Potassium: Red, orange, yellow and almost all green (760 uu – 500 uu).

) 4. Sulfuric copper oxide (in ammoniacal solution): Some green, also blue, indigo and violet (500 μμ - 400 μμ). (

). A mix of 3 and 4 allows only green rays to pass through.

It is not possible to indicate a priori which strength of the various solutions to use. If the light with which one is experimenting is strong, then the use of strong solutions is necessary, and vice versa. You should regularly examine your filter spectroscopically in the light used before each experiment.

Ultra Violet Rays.

These rays cannot be isolated using the filtration method because the filters that block the visible rays will usually also absorb the ultra-violet ones. One must therefore use either the refraction method, which only gives weak light (rock crystal prisms), or light sources, which preferably emit strongly refractory rays, e.g. B. BANGS lamp or STREBELS induction spark lamp.

There is, however, another way out which gives good results in these experiments: one uses e.g. B. the rays of an electric arc-lamp to a number of experiments, and then repeat the experiments with the same rays, after having first applied a solution of acid sulphate of quinine, restraining all ultraviolet rays

have happened. The difference between the results in the two sets of experiments must then be attributed to these ultra-violet rays. If strong light is desired, the rays can be concentrated by a FINSEN concentrator, whose mountain-crystal lenses allow most of the ultra-violet rays to pass through, while the ultra-red rays are absorbed by the distilled water. In the first series of experiments, the visible plus the ultra-violet rays are used, in the second only with the visible rays.

Since there is not only a quantitative but also a qualitative difference between the biological effects of strong and weak light, it is sometimes necessary to be able to work with as strong a light as possible, and this can be done in three different ways, which can of course be combined can:

1. By using a powerful light source.

2. By working as close as possible to the light source; the luminous intensity at different distances is inversely related to the square of the distances.

3. By concentrating the rays of light. You can go very far this way. As an example, I cite that the light concentrated with a FINSEN apparatus at the focus is about 360 times stronger than the unconcentrated light at a 1 m distance from the same arc lamp.

The Effect of Light on Low Organisms.

The enormous amount of energy that is constantly supplied to our earth by the sun's rays is not only the purely immediate condition for all organic life, in that it partly maintains the necessary temperature on the earth's surface and partly makes it possible for the plants to assimilate carbonic acid, it also has such a far-reaching significance for the details in the life of plants and animals, that their forms and colors, their habits of life, and physiological peculiarities are generally adapted to the conditions of light under which they live.

With regard to the highly developed forms of animals and plants, it is in many cases extremely difficult to distinguish to what extent this or that property is the direct or indirect result of the effect of light, or whether its existence is possibly due to completely different causes. The relationship is somewhat simpler when we are talking about the effect of light on unicellular organisms. In this case, because of the less complicated physical structure and the simpler manifestations of life, the individual individuals will react more constantly to one and the same influence, the possibility of wrong conclusions becomes less, and the efforts to find laws for the effects of light thus have greater prospects Success: I therefore find it most natural to present this presentation of light biology. Finseng Medical Light Institute, VIII.

1

to begin with a description of the effect of light on the lower animal and plant forms, all the more so since we are hereby confronted with a series of phenomena which, to a certain extent, acquire a general meaning, because they present us again and again in somewhat different forms counteract the light biology of the higher animals and plants.

-

When a living organism is exposed to light, only the rays absorbed in its body can produce changes in it. The effect of light can be produced in two different ways: either the absorbed rays can be converted and used up in the organism by releasing the energy required for one or the other physiological process - or the exposure can release energy bound up in the organism by only initiates the physiological process (a movement or the like). In the first case, the extent of the effect will depend on the quality and intensity of the rays absorbed, as well as on the duration of the exposure; in the latter case the relation is entirely different; here the light acts as an incitement and in particular the sudden positive or negative swings in the exposure intensity are conditional for the eventual occurrence of the reaction. A slow and gradual increase in the intensity of light, therefore, is often unable to produce an effect where a sudden but often much weaker exposure does.

It is probable, however, that the light also acts in many cases in a similar way to the chemical catalysts, whose importance for the chemical process has been aptly compared to what machine oil possesses for the movements of a machine.

For the colorless microorganisms and sponges, light does not seem to be one of the conditions of life; on the contrary, most thrive better in the dark than in the light. The relationship is different for a number of colored forms, on whose metabolism light has a decisive influence. However, the exposure intensity plays a major role for everyone and very strong light always has harmful effects as far as we know.

The effects of light observed in the lowest organisms consist partly in changes in movement and partly in changes in metabolism; the light can also cause various morphological changes and it can be so intense that it has killing effects.

With regard to the changes in movement, it is sometimes a matter of changes in the form of the organisms or the arrangement of the protoplasm grains, sometimes of changes in the direction or speed of the local movements.

Movements in microorganisms determined by the direction of the light rays, ie in the direction towards or away from the light source, are described by STRASSBURGER) as phototactic. On the other hand, the movement is called photometric or photopathic if the organism in question migrates from a less exposed to a more exposed region (or vice versa), regardless of the direction of the rays. In many cases, however, it is extremely difficult to distinguish between the two qualities of movement.

The possibility for such movements to arise is already possible with a one-sided exposure of the contractile tissue, even if this is thought to be built completely the same through and through

I) STRASSBURGER, Effects of light and heat on swarm spores. Jena 1878.

could. If you expose z. B. an amoeba lying in water, it would be conceivable that photochemical processes occur with greater intensity on the side facing the light source than on the side facing away from it, where the rays of light only reach after they have been weakened by passing through the protoplasm of the amoeba and such a difference between the two sides must be able to cause movement in one direction, which can depend, among other things, on the direction of the light rays.

Phototactic movements have been observed in various forms of infusoria, in lower algae and their swarming spores, in oscillarines, diatomaceous plants and in individual bacteria (e.g. sulfur bacteria).

They are often green or at least colored forms; but such light-regulated movements have also been found in some unstained ones, such as in the Plasmodium of the Myxomycetes, Pelomyxa and in the gametes of the Chytridium vorax. To what extent the phototactic movements for the individual forms such. B. the above are peculiar or whether they can be evoked in all self-moving organisms is currently undecided. The possibility cannot be ruled out that by using greater variations in the intensity of exposure than previously attempted, one will also find accessible those kinds of influence in which experiments have hitherto yielded negative results.

From the first half of the 19th century there are already a number of observations on the peculiar movements that can be observed in the swarming spores of various algae when these e.g. B. are placed in a porcelain bowl and exposed. SACHS') showed that

1) Sachs, Lectures on Plant Physiology. Leipzig 1887.

A large part of these movements, which were previously regarded as purely phototactic, can be traced back to currents in the water, which is heated unevenly on the different sides of the shell during exposure. Shaking OL with diluted alcohol of about the same specific gravity, he was able to produce an emulsion which, when exposed to light, produced figures very similar to those observed in the swarm spores experiments. Coun"), STAHL?) and others, however, succeeded in demonstrating really phototactic movements that are independent of the heat flows and which, in contrast to these, are particularly of "cold" - blue-violet ones

“ and ultra-violet rays.

STRASSBURGER 3), who has made a great deal of research into phototactic movements, describes, 2. E.g., the behavior of the swarming spores of Botrydium granulatum, suspended in a drop of water, when brought from the dark into the light. At first sight under the microscope he saw them evenly distributed in the drop, but they turned very quickly towards the light with their foremost end and moved at high speed in approximately parallel lines in the direction of the light source. After the lapse of a few minutes all the swarmers were gathered near the rim facing the light. If the specimen was then rotated 180°, the swarmers left the edge now turned away from the light at the same moment, and rushed towards the light again.

It is customary to distinguish between positive and negative phototactic movements, depending on whether the light attracts or repels photosensitive organisms. But there are also forms which are sometimes positive, sometimes negative phototactic, in that their movements depend entirely on the intensity of the light. While they do not respond to moderate exposure, they seek out the light when it is weak and shun it when it is strong. If e.g. If, for example, a glass bowl with water in which there are light-sensitive swarming spores of this or that type of algae is placed in diffuse daylight, the water has a fairly uniform green colour, the swarming spores swimming around in all directions without their movements being visibly influenced by the light. If the bowl is placed at the back of a room where the light is poor, they will all rush towards the side that is best exposed, and conversely they will try to flee the light in direct sunlight.

1) Bot. Newspaper 1867. 2) Bot. Newspaper 1878 and 1880. 3) I. c.

STRASSBURGER) discusses some experiments with Plasmodium of the Aethalium.

In very faint light they came upon the surface of the substratum in which they lived; if you increased the intensity of the light, they immediately withdrew.

It is not unreasonable to assume a similar relationship in a part of organisms in which only either positive or negative phototactic movements have been observed so far, so that in reality they behave positively phototactically to weaker light and negatively phototactically to stronger light. The light intensity used was relatively weak in a number of the series of studies and it is known that the "optimal exposure" is not the same for all species; you can,

it means to be "attuned" differently to the light. Yes even within the

I) I.c.

man

variations can be observed of the same kind; the fertilized hawk moths of Voloox glabator are e.g. B. voted for a weaker exposure than the unfertilized ones, and STRASSBURGER") states that the light mood can also vary with the age of the spores as well as with the temperature and the oxygen tension in the surrounding water. By getting used to an acclimatization, the also change the mood of the light.

A second phenomenon called "polarity" can be observed in various unicellular algae (closteria, pleurotenium, etc.). It consists in the algae in question aligning themselves with their longitudinal axis in the direction of the radiation when exposed to light; if this is changed, the alga follows the movement. Sometimes, after a few minutes of exposure, one observes a sudden turn of the alga so that its opposite end faces the light (alternating polarity).

" Phototonus" refers to a state of irritability in which a proportion of both chlorophyll-containing and chlorophyll-free microorganisms can be brought by exposure to moderately intense light. Such organisms do not move, or at least move only slowly, in the dark (dark torpor), and the movements also stop in very intense light (photophobic). This need not be conditioned by the death of the organism in question; because the movements can be recorded again under more favorable lighting conditions,

ENGELMANN?) examined in 1879 the effect of light on the protist: Pelomyxa palustris. This amoeba

1) I.c.

2) Archive for all Physiology, XIX, p. 1.

similar organism moved vigorously in the dark, with continuous extension and retraction of pseudopodia; however, when suddenly exposed to light, it stopped moving and contracted into a spherical shape. The reaction did not occur with a gradual transition from dark to light, nor with a sudden transition from light to dark. After the exposure had lasted for a while, he resumed his usual amoeboid movements. However, not all forms of amoebas behave in this way. DREYER') bred a freshwater amoeba in Finsen's laboratory and examined its relationship to light. It moved briskly in the light, slowly in the dark, and he never observed a momentary contraction when he suddenly exposed it to the light. Blue light exerted the same effect as white, while red light acted like dark.

HARRINGTON and LEAMING?) found that Amoeba Proteus ceases its movements on sudden exposure to highly refractable rays; however, it does not contract into a sphere, but a "light rigidity" occurs, in that the amoeba retains the shape it had immediately before exposure; after the lapse of a few minutes the protoplasmic currents resumed. In red light, the movements were lively, and the mentioned rigidity occurred only with a sudden exposure transition from less refractable to more refractory rays - not vice versa. Red light acted as a stimulus to the movements of the amoeba when kept in darkness for a period of time; it does not, however, seem out of the question that a thermal effect made itself felt in this last attempt, of which

1) Notifications from Finsens med. Lichtinstitut, H. IV, p. 81, 1903.

2) The American Journal of Physiology, Vol. III, No. 1 Aug 1899.

In any case, correctness is not confirmed by DREYER's above-mentioned investigations. DAVENPORT'), who also worked with Amoeba Proteus, found it to be negatively phototactic to light of intensity varying from diffuse daylight to direct sunlight; photopathic movements, on the other hand, were not observed.

As another example of how unicellular organisms react to sudden fluctuations in exposure intensity, the peculiar phenomenon ENGELMANN ?) has named "startle movement" is worth mentioning. He observed it in a purple bacterium, the so-called Bact photometricum. This ciliated bacterium moved only in the light; if he ruled this out, the movements gradually became slower and finally stopped altogether. (WINOGRADSKY), who worked with different chromatic organisms, found that they only stopped moving after staying in the dark for ten days.) If ENGELMANN looked at a drop of water with these bacteria under the microscope under ordinary lighting, he saw them swimming around calmly, he weakened them suddenly the lights

by e.g. B. shaded with one hand, the bacteria moved back at the same moment in the opposite direction from the one in which they had been moving before, then stood still for a few seconds with lively rotation about their longitudinal axis - a rotation which was also in the opposite direction to the previous one accomplished

so again to take up the usual forward movements. The length of the retrograde Be around

I) DAVENPORT, Experimental Morphology, Part. I, p. 187, New York 1897.

2) Archive î. i.e. total Physiology XLII, p. 183, 1888. Bot. Zeitung XLVI, 1888.

3) Bot. Zeitung XLV, p. 489, 1887.

movement was equal to 10-20 times the animals' own length. With the gradual weakening of the illumination, this startled movement did not occur; the bacteria continued to move for a time (photokinetic aftereffect), but the speed steadily decreased until all movement stopped (dark rigor). The "startle move" could only be evoked with negative lighting changes, suddenly increasing the lighting had no effect other than causing the normal forward striding movements to increase slightly in speed.

These conditions explain another observation by the same author, namely that the bacteria mentioned (Bact. photometricum) accumulated in a partially exposed drop at the exposed areas. If they move from the exposed area into the shadows, the "startle movement" will occur, while they can swim unhindered from the shadows into the light. The exposed area therefore looks like a trap. An even nicer experiment, which must also be related to the relationship described as “startle movement”, is the one which ENGELMANN1) prompted to give this bacterium the name: “Bact. photometricum” to give. Under the microscope, he exposed a drop of these bacteria to light that was refracted through a so-called microspectral lens, and it was found that the bacteria accumulated at those points in the spectrum that corresponded exactly to the absorption lines in the absorption spectrum of the bacterial dye. The phenomenon becomes understandable when one realizes that the rest of the spectrum must appear dark in relation to these lines.

I) Archive fd sat. Physiology, XXX, pp. 95-124, 1883.

In various other lower animal and plant forms he demonstrated similar accumulations in certain sections of the microspectrum. Paramecium bursaria clustered in the red part (between line Bund D), while Euglena viridis clustered in the blue around line F.

Through a series of interesting investigations in which he tested the effect of light with changing oxygen tension, ENGELMANN 1) sought to gain a closer understanding of the effects of light mentioned; he came to the conclusion that light can affect the movements of lower organisms in at least three different ways, namely:

1. Directly through an effect on the metabolism without a demonstrable contribution of a feeling, a perception. – Naviculaceae contain chromophyll and excrete oxygen in the light. Now the presence of oxygen is a necessary condition for the movements; on the other hand, if the naviculaceae are in oxygen-free environments, they can move at the expense of the oxygen they produce themselves with the help of light. The light therefore evokes movements again if these have stopped in the dark due to lack of oxygen. On the other hand, if there is sufficient oxygen supply to the surrounding liquid, the light has no influence on the energy of the movements.

2. Through an effect on the metabolism and a consequent change in the feeling caused by the need for oxygen. – Paramecium bursaria moves very little with normal oxygen supply and in this state does not react to light at all (the light is not particularly intense). On the other hand, if the oxygen tension drops, the

I) Archive fd sat. Physiology, XXIX, pp. 387-400, 1882.

Paramecia restless and look for the oxygen-rich areas. Kept in the dark, they pile up under a coverslip at the edge of it or around the adventitious air bubbles. If the drop is exposed to reasonably clear daylight, no such accumulation will take place, probably because the oxygen production from the illumination is able to compensate for the insufficient supply of oxygen from the outside.

If the oxygen tension decreases to a significant degree (ENGELMANN directed a stream of hydrogen over the coverslip), the Paramecia become restless in the dark and move at a very considerable speed. If you now expose them (with red or white light), they become calmer again. In this state they react particularly vividly and sharply to changes in the light, and if they happen to be overshadowed by the light, they immediately turn back.

When the oxygen tension is increased, the relationship is quite the opposite. Here the Paramecia become restless in the light, on the other hand they are calmer in the dark, now they flee the light (especially red light) just as they used to flee the dark, and they only pass the boundary in the direction from light to dark.

3. Through a specific process that is believed to correspond to our ability to see. ENGELMANN mentions as an example: Euglena viridis, which is extraordinarily sensitive to the effects of light. The light reaction here is almost independent of the oxygen tension and the light perception is located exclusively in the front part of the body where there is currently no chlorophyll.

The phototactic movements can probably also be carried out in ways other than those mentioned here

cause, and the different processes are certainly often combined.

In most cases the highly refractable blue-violet rays cause these movements, while the red-yellow ones have a much weaker effect. As already mentioned, the purple bacteria and a few others are exceptions. The red-yellow rays are particularly effective in cases where the lighting effect is based on CO2 decomposition.

Analogies to phototaxy in the lower organisms are found in plants in some of the so-called heliotropic movements (others of which are due to osmotic pressure changes in the stalk members), and in animals in some of the movements which are later discussed in the section on the inciting action of light animals are described.

1

The effect of light on fibrillating cells.

As mentioned earlier, light has a movement-inducing effect on several ciliated microorganisms. VERWORN 1) could cause movements on otherwise sedentary Pleuronema chrysalis with blue-violet rays; the effect of less refractable rays was significantly weaker.

Most infusoria move just as quickly in the dark as in the light, unless the intensity becomes so intense that it is harmful to the animals. If this is the case, the light first has an inciting effect, then paralyzes and finally kills.

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I) VERWORN, Psycho-physiological protist studies, Jena: 889. common physiology", Jena 1895,

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Uskow 1) studied the effect of light on simmering epithelial cells of the esophageal mucosa of frogs. He found that if he replaced the blue glass used as a light filter with a red one, the flickering motion that was vividly going on in blue light suddenly ceased; however, movements resumed after a few hours at the same rate as before. This phenomenon, which to a certain extent would correspond to the "startle movement" of ENGELMANN's Bacterium photometricum, has not been possible for me to prove, despite a large number of investigations. I put ciliated cells in a drop of physiological saline and mounted them under the microscope in a dark room with a hole drilled in one wall for light to pass through.

In front of the hole I placed alternately a 5 per cent. solution of ammoniacal copper oxide, which allowed only the blue-violet rays to pass, and a 1 per cent. fuchsin solution, which retained all the visible rays except the red. I used a 20 amp electric projector lamp as the light source. I watched e.g. B. a small exposed clump of cells, kept in constant and fairly regular rotation about their axis by the fibrillation motion. In blue light, the number of revolutions was 36 per minute. An assistant quickly swapped the blue filter for the red one, so that I didn't take my eye off the microscope myself; there was no arrest or change in fibrillation motion and the rate of rotation of the clump of cells was 36 per minute consistently. The movements were also not affected by a sudden strong exposure after a period of complete darkness.

1) Centialll. fd med. Sciences 1879, no. 25

BERGEL, who worked with esophageal cells from curarized frogs, found that the so-called ciliated bodies (individually torn off ciliated cells that often contract into spherical shapes) stopped their fibrillation movements in the dark and resumed them after a long exposure to light. These investigations found no corroboration by my own experiments either. I did not succeed in ascertaining such an effect of light on the flickering movement; once this had completely stopped , it did not return even when the cell was exposed to very intense light. (I took the cells now from normal, now from etherized, now from curarized frogs).

During my investigations I got the impression that the total cessation of the fibrillation movement is equivalent to the death of the cell in question. With an intense exposure to highly refractory rays, I could just bring the ciliated cells to rest; but as it is probably a matter of killing, I defer a discussion of it to a later section.

A review of JACOBSON's 1) interesting studies on the effect of light on eosin-stained ciliated cells is given in the section on sensitization.

Temporary changes in shape, etc. It has been mentioned earlier that Pelom yxa palustris contracts into a spherical shape when exposed to sudden exposure to light. FINSEN?) made the observation, later corroborated by Bang, that the elongated red blood cells in tadpoles contract and round off in strong light, and TOMASCHEFSKI) and DREYER?) found a similar contraction in various infusoria when subjected to brief intense exposure had been exposed. Since the surface of the animals decreases, the more the shape of their body approaches the sphere, they are also hit by fewer rays of light, and it is therefore obvious to see in the contraction a movement of expediency, a movement of protection against the too strong light. One must be careful, however, in applying such a teleological view of these relationships en bloc; the examples given are not analogous at all in reality. In the former case, it is a kind of “startle movement” evoked only by a sudden, positive swing in exposure intensity; after a few minutes the animal resumes its usual amoeboid movements. On the other hand, the contraction of the infusoria must be understood as a purely debilitating phenomenon, which is often premortal. It emerges very clearly when the animals are simultaneously exposed to e.g. B. with the strongly refractive rays of an iron lamp, observed under the microscope. The contraction does not occur instantaneously, but only after a longer intensive exposure, when the body movements of the animals have already stopped. If the infusoria survive the exposure, it may take a long time, sometimes two days (DREYER")) before they

1) Journal of Biology, Vol. XLI, 1901.

2) FINSEN, On the importance of chemical radiation for medicine and biology, Leipzig 1899.

return to their normal form. Finally, in the Infusoria this contraction is not peculiar to the effect of light; it also occurs when the animals are exposed to a harmfully high temperature, when they begin to dry up, or when they are exposed to various toxins.

The experiment on the frog corpuscles remains as the only example where the contraction might perhaps bear the semblance of the stamp of the expediency movement. If you examine the webbed web of a frog through a microscope, you will see how the black pigment cells are arranged around the blood vessels, around which they form a dense network with their numerous, anastomosing processes. FINSEN 1) has drawn attention to the fact that this anatomical Ratio could indicate a need for protection of the blood vessels or their contents against the light. Incidentally, he is now of the opinion - after experiments carried out later in his laboratory - that it is possible that his earlier view of the contraction of blood-corpuscles was incorrect, and that the cause of the change in shape observed by him was a change in osmotic pressure and not an effect of light is to be sought.

The light is also able to bring about changes in the storage of the protoplasmic grains within the individual cell. In multicellular algae, for example, the chlorophyll grains are stored in different ways in the dark and in the light, a relationship that will be described in more detail in the discussion of the effect of light on chlorophyll in the higher plants.

AUERBACH?) observed under the microscope how the black pigment in eggs of Rana temp.

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1) Works from the light department in Prof. WELLIERMINOFF's clinic by KP SERAPIN, vol. I, 1902, p. 260. (Russian.)

2) Communications from FINSEN's med. Light Institute, VII, Jena 1904.

3) I.c. Notices a. Finsens Medical Light Institute. viii

I) I.c.

2) Central Bl. fd med. Science 1870, p. 357.

pushed beyond the white pole when it was exposed. The white spot was finally able to disappear completely, while at the same time a new one formed on the previously black side. When the egg was rotated again, the pigment returned. It is not known to what extent a real and definitive rotation of the pole can be brought about in this way, which is of importance for the further development and position of the embryo.

STAHL mentions' that the direction in which nuclear division takes place in Equisetum spores depends on light. is influenced, so that the two daughter nuclei come to lie in the direction of the rays. The nearest to the light source is the nucleus of the prothallium cell, while the farthest is that of the root cell.

A number of examples are known of exposure causing shape changes and pigment shifts in the retinal cells and in the skin of various reptiles (chameleon color change), but I will make these phenomena the subject of further discussion later, partly because in many cases it is not a direct effect of the light on the individual pigment cell, but a reflective process.

The influence of light on metabolism.

Light has a similar importance for the metabolism of chlorophyll-containing algae as for that of higher plants, in that it is a necessary condition for the assimilation of carbonic acid (see later). According to ENGELMANN 2) the purple bacteria excrete oxygen in the light and their pigment must apparently act in a similar way to chlorophyll; the evolution of oxygen can be effected by all visible rays, but it is most powerful in the most strongly absorbed light. In the long run, these bacteria can only grow and multiply in light. ELFVING") studied the effect of ordinary daylight on the metabolism of mold fungi. He found an inhibition of synthesis by light, especially on the part of ultra-violet rays; but the effect was weaker the closer the composition of the nutrient medium of the fungi was to that substrate formed during synthesis (protoplasm) On respiration on the destructive process

1) Reports of the bot. Society 1885, p. 334. 2) Archive fd ges. Physiology 1888, XLII, pp. 183-186.

the light had no effect on the adult molds; on the other hand, in young fungi, where the synthesis proceeded vigorously, an inhibitory effect took place.

This ratio corresponds exactly to that found in higher plants. In the animal cell, metabolism is enhanced in the light; the experiments by MOLESCHOTT and FUBINI, discussed in more detail later?), indicate that animal tissue absorbs more oxygen in the light and excretes more carbon than in the dark. This very interesting circumstance, whose physiological importance is fundamental, nevertheless calls for further confirmation.

The influence of light on growth and reproduction.

It is a general rule within plant physiology that all growth is more vigorous in the dark than in the light, especially when the light contains strongly refracted rays (light, however, is a necessary one

1) ELFVING, Studies on the action of light on fungi, Helsingfors 1890.

2) Investigations on natural science by MOLESCHOTT 1881, vol. XII, p. 266. Condition for the full development of various organisms such as e.g. B. the leaves). According to ELVING 1), the growth of mold stops completely in direct sunlight.

Most chlorophyll-free microorganisms (e.g. bacteria) are known to multiply faster in the dark than in the light. Only in very isolated cases was it thought that faster growth could be observed in the light than in the dark (GAILLARD %), SCHENK 3)); the light in these cases has undoubtedly been of low intensity.

The basidiomycetes require light so that fructification can take place; in the dark only a sterile mycelium is developed (BREFELD 4)).

King 5) has recently attempted to explain various clinical and epidemiological peculiarities of malaria on the assumption that the sporulation of malarial plasmodia takes place only in the light, or at least is favored by light, and especially by red light. Such a favorable action of the red rays of light on chlorophyll-free micro-organisms would be quite unique, and experiments by HARRINGTON and LEAMINGS, discussed elsewhere, on which KING bases his hypothesis, prove nothing in this respect.

With regard to the chlorophyll-containing forms, the matter is somewhat different. While the mold spores of various algae develop easily in the dark, their release, according to WALZ) and STRASSBURGER), is promoted to a high degree by the light. If kept in the dark, the algae can stand with full sporangia for a comparatively long time; on exposure to light, on the other hand, the sporangia begin to empty within a few minutes. The same is the case, however, when fresh water is poured over the algae, and it must therefore be assumed that the light effect here is based on the formation of oxygen or ozone at the beginning of assimilation.

1) I.c.

2) These de Lyon.

3) KOCH's annual reports on progress in the study of fermentation organisms, 1893, p. 53.

4) BREFELD, investigation. ad total fee i.e. Mycology, 1889, Issue 8.

5) Washington Medical Annals, 1902, Vol. 1.

6) Botanical Newspaper 1868.

The influence of light on the formation of pigments in bacteria

and the biological importance of these dyes.

While light is most often a necessary condition for the formation of chlorophyll, both in algae and in higher plants (see below), the pigments of bacteria generally develop best in the dark. However, there are a number of exceptions to this rule, and the importance of the pigment in bacterial biology is also not always the same. BEJERINCK") distinguishes between three main groups:

1. Chromophoric bacteria. In these, the pigments are deposited in the same protoplasm and, from a biological point of view, correspond to the chlorophyll of plants, in that they determine the excretion of oxygen in the light. Example: the red sulfur bacteria (purple bacteria). In some species the pigment — according to ENGELMANY and Van TIEGHEM3) — is even identical to chlorophyll (Bact. viride, Bact. chlorinum, Bac. vireus).

1) STRASSBU'RGER, Effect of light and heat on swarm spores, Jena 1878.

2) Botanical Newspaper 1891.

3) Cit. after FLÜGGE, The Microorganisms, 1896.

The condition for the dye production of the chromophoric bacteria coincides with the living conditions of these bacteria.

2. Parachromophoric bacteria. In these the pigment is readily deposited in the cell membrane of the bacteria, and it does not appear to have any metabolic importance as in the bacteria in the preceding group. – Example: Bact. violaceus, Bact. janthinus (violet).

3. Chromopare bacteria or true pigment bacteria excrete the dye as excretion, thereby coloring the surroundings; perhaps the pigment as such is not preformed in the bacteria, but these are colorless and secrete a substance which only z. B. is colored by the connection with the oxygen of the surroundings. In these bacteria, pigment production only takes place under certain optimal cultivation conditions, with regard to which, among other things, the temperature, the composition of the nutrient substrate, the oxygen supply and the lighting conditions are important. Under other cultivation conditions, the color formation may not occur, even if the bacteria otherwise grow briskly.

Example: Bac. prodigiosus (red), Bac. cyanogenes (blue), Bac. pyocyaneus (green).

Nothing definite is known about the importance of the pigment for the bacteria in the last two groups.

The bacteria behave differently towards light with regard to the formation of dyes. Micrococcus ochroleucus grows---AFTER PROVE)--colorless in the dark while

1— It forms sulphurous yellow cultures in the light. Apart from the chromophoric bacteria, this is the only example that light can be a necessary condition for the formation of pigment, and a closer study of which light rays are decisive here would be of great interest.

1) Contributions to the Biology of Plants, IV, by F. Cons. cit. after FLÜGGE, The Microorganisms.

GROTENFELD 1) described a bacterium that only forms its pigment in the dark, and for the majority of chromoparous bacteria it is probably true that light (especially the strongly refractive rays) exerts an inhibiting influence on the formation of pigment. Prepare a surface culture of Bac. prodigiosus on agar-agar in a Petri dish and places it under different lighting conditions from direct sunlight to complete darkness in a room temperature of 17-18°, a 24- or 48-hour later investigation according to our own experiments yields the following result: In direct sunlight are the cultures

because of the bactericidal effect of light - did not develop at all. In strong daylight: weak growth, no color formation. In something weaker

, The cultures are almost as well grown in daylight as in the dark; the color is grey-white. The red color first appeared in cultures which had been placed on a table in the middle of a room with an east-facing window, and the cultures which were in complete darkness under otherwise identical conditions proved to be the most intensely colored. Dye formation in Bac. prodigiosus can also be prevented in various other ways; e.g. B. by growing at a temperature above the optimum level. The fact that the ability of light to weaken or prevent the formation of color is not based on a heat effect is evident from my experiments with the greatest clarity (I include the in

1) Medical advances 1889.

cultures exposed to direct sunlight). The fact that the highly refractory rays are more effective than the less refractory ones also argues against the heat effect being the decisive one. LAURENT') has shown this with regard to the "Kielerbacill" and D'ARSONVAL and CHARRIN) found the same relationship with Bac. pyocyaneus, while DIEUDONNÉ 3) even stronger color formation in Bac. prodigiosus claims to have observed when the cultures were exposed to red light instead of standing in the dark. BECK and SCHULTZ4) studied the effects of the different spectral regions on the color formation in Bac. prodigiosus, but their results are somewhat ambiguous, probably because they used too low-intensity light.

Cultures of Bac. prodigiosus on agar, one will repeatedly find individual colonies which, in contrast to all the other colonies, remain unstained for a while. Upon exposure to light of recently sown surface cultures of Bac. prodigiosus with concentrated light for such short periods of time as not to sterilize the agar surfaces, unstained ones are often found particularly numerous between the adult colonies, whether this is due to the presence of pre-existing unstained colonies which are more resistant to the light than the stained ones or that the light may have robbed the bacteria in question of their ability to produce dye.

However, the lack of color formation in Prodigiosus cultures grown in diffuse daylight can also be explained in another way. I left surfaces

I) Annales de l'Institut PASTEUR 1890, p. 465.

2) Comptes rendus Acad. des Sc., January 1894.

3) Works from the Kaiserl. Boards of Health, Vol. IX, 1894.

4) journal f. Hygiene 1896.

cultures of Bac. prodigiosus grow in the dark until the color was nice red, and then placed the Petri dish in question in sunlight or only diffuse daylight, the cultures discolored after a shorter or longer time, depending on the strength of the light used. This is obviously not a question of preventing the formation of the dye, but simply of bleaching the one that has already formed. It is therefore conceivable that in a Prodigiosus culture developing in daylight, there is constant, normal production of pigment, which, however, is destroyed just as quickly by light - bleached.

If a Prodigiosus surface culture, which developed colorless in daylight, was placed in the dark and under good growth conditions, it turned red during its later growth. This experiment shows that in this case the lack of color formation in the light is not due to photochemical changes in the nutrient substrate, an explanation that immediately presents itself when one considers that the light chemically affects organic substances in so many cases and that the morphological Characteristics of the lower organisms not infrequently vary with the nutrient medium on which they grow. The experiment also shows that in general there is no transfer of the lack of pigment to the following generations if they are only protected against the effects of light. However, as can be seen from the following, the opposite can also sometimes be the case.

Permanent (hereditary) morphological changes.

The so-called “Kielerbazill”, first bred by BREUNIG, produces purple-colored colonies when bred on potatoes in the dark. By exposing this germ to light, LAURENT) succeeded in 1889 in getting a colorless form that would remain constant for many generations. At FinSEX's laboratory, Bie managed to produce a prodigiosus culture in broth by brief exposure of a series of successive generations to concentrated light, which has now remained unstained for about 1 year. (I have recently grown this colorless Prodigiosus on a number of different growing media and temperatures without ever obtaining coloration from the cultures.)

There are also examples from quite different areas that exposure can cause persistent and hereditary variations in the morphological peculiarities of an organism. LAURENT ?) found a community between two hyphomycetes "Dematium pullulans" and "Cladosporium herbarum" and he succeeded experimentally in inducing transformations from one form to the other. He sowed spores of Penicillium cladosporioides (a form of Cladosporium) in wort, and exposed it to sunlight for 4-5 days; after Uinsäen they evolved as dematium, and this form was constant from generation to generation. While Cladosporium is obligately aerobic, Dematium can live anaerobically.

ELFVING 3) work with spores of Aspergillus glaucus (Eurotium). By breeding them in the light, he succeeded in developing three new forms of the Penicillium type, and these types remained constant. Now it is a well-known fact that TưLASSE drew attention to more than half a century ago

1) Annales de l'Institut PASTEUR 1890, p. 465.

2) Annales de l'Institut PASTEUR 1888.

3) ELFVING, Studies on the action of light on fungi, Helsingfors 1890.

knowledge that one and the same mold can appear in very different forms, and that pleomorphism in the reproductive organs of fungi is very common. It is therefore obvious, especially in this area, to observe a certain skepticism about the durability of the new species. ELFVING, meanwhile, has followed "Penicillium eurotii" as he called it for a very long time without ever observing a reversion to the original fructification mode. ENGELMANN 1) and GAIDUKOW?) intend to

recently published some very interesting experimental studies on artificially induced, hereditary color changes in living chromophyll-containing plant cells. By prolonged cultivation in monochromatic light, GAIDUKOV succeeded in producing color changes in the oscillariné cultures he was working with; the changes bore the stamp of expediency in that the plant cells constantly assumed the color complementary to the color of the rays to which they were exposed, that is, the color which most strongly absorbed those rays: the originally violet cultures of Oscill. sancta became after two months of breeding

in red light green,

yellow

blue green

green

red and in blue

brown-yellow. The authors refer to this phenomenon as "complementary chromatic adaptation" and regard it as a physiological adaptation process

a vital color change beneficial for assimilation.

1) Archive f. Anatomy and Physiology 1902 and "Verhandl. i.e. physiological society at Berlin, November 1902.”

2) treatises of the royal Prussian Acad. d. scientific to Berlin 1902.

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It is well known that only brown or red colored algae and types of seaweed are found in greater sea depths, while the green forms are already found at a depth of

disappear. Since water is less permeable to red-yellow rays than to green and blue rays, the sunlight passing through it will gradually change in composition as its total intensity decreases. The light with the help of which the assimilation of deep-water plants must take place is therefore greenish-blue, and Engelmann hypothesized a number of years ago that the red color of these plants is due to an adaptation to the prevailing lighting quality. This hypothesis has now found experimental confirmation by the experiments mentioned above.

In addition, GAIDUKOV's investigations yielded the result that the complementary color change achieved by long-term exposure to monochromatic light persisted when the algae were later cultivated in ordinary daylight, and ENGELMANN believes that these experiments confirm his earlier assumption that the The yellow and red algae that live on the sea surface are descended from forms that used to live at greater depths under the influence of the blue-green light that prevails here.

Such an experimentally induced change in the morphological properties of an organism, a change which arises relatively quickly and yet is of such a radical nature that it is inherited and is constant from generation to generation, is of very important developmental interest, even if the newly created species which is often the case as forms of degeneration, a word that doesn't really explain anything in this context. It is well known that lasting morphological changes can also be brought about in ways other than exposure to light, and from the observations of the Dutchman DE VRIES 1) it is evident that these do not arise exclusively from experimentally induced changes in the living conditions, but that they also change find in nature; he has given interesting examples of how wild plants can produce significant variations within a single generation, or at least very few, that remain constant in succeeding generations.

The ability of light to influence the virulence of pathogenic bacteria

to belittle toria. ARLOING ?) sown antrax cultures, which had been exposed to sunlight for various lengths of time, in flasks of broth and inoculated them on guinea pigs. The longer the cultures were exposed to light, the slower the broth became cloudy and the virulence of the bacteria decreased with the duration of exposure, so that the longest exposures did not kill the vaccinated guinea pigs, even if they were still growing in the broth showed. These guinea pigs were subsequently found to be immune. The cultures became vaccinal with an exposure of about 30 hours. – The weakening of virulence was due to the shortwave rays, while the red, yellow and green seemed to be ineffective.

1) Bot. Centralbl. 1899, Vol. LXXVII, p. 327; biologist. Central Bl. 1900, Vol. XX, p. 193.

2) Comptes rendus 1885, Vol. C-CI.

DUCLAUX 1), PALERMO 2) and CHEMELEWSKY3) found a similar reduction in the virulence of various micrococci and pyogenic bacteria, and d'ARSONVAL et CHARRIN) which with Bac. pyocyaneus showed that the light first abolished pigment formation, then growth and virulence, and finally killed the bacteria.

The following tests by MOMONT 5) show that the reduction in virulence does not last in the following generations: anthrax bacilli in blood were spread on sterile glass plates and dried; after 6½ hours of insolation, a piece of the glass plate inserted under the skin of a guinea-pig no longer caused anthrax; a second piece of the same glass plate was placed in broth in which bacteria developed which proved virulent when inoculated on guinea pigs.

The bactericidal nature of light.

The useful or harmful effect of light on living beings depends partly on the individual characteristics of the organism concerned, partly on the type and intensity of the rays and the duration of exposure -- finally partly on some physical circumstances to be discussed later (temperature, oxygen tension, etc.). etc.) determined.

We have already seen in the discussion of the phototactic movements how e.g. B. trying to set the swarming spores of the algae under otherwise the same conditions according to a specific optimum exposure that varies with the type, age, etc. of the exposed individual. One may assume that this intensity of exposure under the given conditions is the most favorable for the existence of the individual in question: with a weaker exposure there will be a reduction in carbon assimilation, with a stronger exposure there will be a weakening of growth and the ability to reproduce, and a further increase in the intensity of exposure will exert a killing influence.

1) Comptes rendus 1885, Vol. C. 2) Ref. in Centralbl. f. Bacteriology 1895, XVIII, p. 665. 3) Ref. in Centralbl. f. Bacteriology 1892, XII. 4) Comptes rendus Acad. of the sc 1894. 5) Annales de l'Institut PASTEUR 1892, VI.

A similar relationship can probably also be asserted for all other organisms; for some (e.g. most bacteria) the optimum exposure is certainly very low, since they multiply and grow most vigorously in very weak light, or perhaps even in absolute darkness. While there is no known direct beneficial influence of light on a large proportion of organisms, the harmful effect of excessively intense light seems to be common to all living beings, at least during certain periods of life.

The most numerous and most detailed investigations into the killing effects of light have been carried out with bacteria as test objects, mainly because of the great practical and hygienic importance of such investigations. We owe the pioneering work in this field to the English authors DOWNES and BLUNT', whose first paper appeared in 1877. Since that time, a number of researchers have thrown themselves into the study of these relationships with great zeal - at least a few hundred large and small papers are already available - and the introduction of the

concentrated electric light as a therapeutic agent for various bacterial skin diseases (FINSEN ?))

I) Proceedings of the Royal Society of London 1877, XXVI, p. 488.

2) FINSEN, On the importance of the chemical rays of light for medicine and biology, Leipzig 1899

has breathed new life into investigations over the last 10 years.

As with all other light-biological phenomena, when talking about the bactericidal ability of light, one generally ignores the heat effect of the rays. It is self-evident from the outset that the heat rays, if their intensity is sufficiently high -- with successive heating of a medium in which the bacteria are located, can destroy them, just as conduction heat can do.

DOWNES and BLUNT, meanwhile, showed by their experiments that sunlight is capable of killing bacteria by means quite different from that of heat, and that in this respect the highly refractory rays are the most effective, notwithstanding the comparatively small amount of heat energy which they represent are. They made their experiments with mixed cultures of bacteria inoculated into small test tubes with Pasteur liquid. They placed some of the test tubes in a number of differently colored glass boxes and then exposed them to sunlight; others mounted them lightproof in lead cases. It turned out that the bacteria developed most quickly in the last test tubes, which were completely protected from the light; then came those in the red glass box, the walls of which allowed only the passage of the red and orange rays. Still later growth resulted in the cultures surrounded by the yellow glass; through this passed the whole visible spectrum, with the exception of the violet rays and about half of the blue rays. In the test tubes placed in a blue or uncolored glass box, the bacteria did not develop at all. Notices a. Finsens Medical Light Institute. viii

Despite the rather primitive experimental arrangement, these authors were already able to determine that the bacterial growth-inhibiting resp. The bactericidal effect of the solar spectrum on the visible rays has its maximum in the violet, decreases sharply in the blue-green and can still be felt in the red part of the spectrum.

MARSHALL WARD!) had the rays of an electric arc lamp broken through a quartz prism and caught the resulting spectrum on agar-agar plates, into which he had shortly before inoculated one or the other type of bacteria in pure culture; after exposure, the culture was placed in the thermostat, and when fully grown he could see directly the stronger or weaker effect of the spectral rays. It was found that the ultra-violet rays had a very strong bactericidal effect; but in these experiments the maximum for bactericidal activity was to be found in the violet part of the spectrum.

Among the methods used in experiments on the bactericidal nature of light, Buchner's also deserve mention. He used agar plate cultures in dishes with a cross or something similar made of lightproof paper stuck to the bottom; the dishes were lighted with the bottom facing the light source and the part of the culture protected by the light-tight paper served as a control.

FINSEN 2) inoculated bacteria into liquid agar and allowed this to clot in a thin layer on the inside of small rectangular bottles; on the outside he drew a number with asphalt varnish, which shaded part of the culture during exposure. He used concentrated light from a powerful electric arc lamp, and the bottles were treated with cold

water trickles over. He confirmed the avoidance of any harmful heat effect in the individual experiments by the emergence of growth behind the drawn number, where the absorption of the heat rays was

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1) Proceedings of the Royal Society of London 1894, LIII-LIV.

2) FINSEN, Om Anvendelse i Medicinen af koncentrerede kemiske Lysstraaler, Köbenhavn 1896.

strongest, but where on the other hand the bacteria were protected against the effects of the chemical rays. The cultures were exposed in as many minutes as the number of resp. indicated bottles, and then placed in the thermostat; after 24 or 48 hours, after removal of the asphalt varnish, it was possible to read directly from the mature cultures which exposure times had sufficed to kill the bacteria or weaken their growth.

FINSEN later switched from glass bottles to the use of small metal bowls, the base of which is formed by cut quartz plates with plane-parallel sides; Quartz has the advantage over glass that it absorbs ultra-violet rays to a significantly lesser extent.

Sometimes one does not use Koch'sche plates process cultures, but z. B. dried drops of broth cultures; after exposure, the bacteria are doused with a drop of agar, in which growth will occur if absolute killing is not achieved. In this way, the absorption of rays that would otherwise occur in the nutrient medium is avoided, and at the same time one protects against a possible harmful effect on bacteria from substances sometimes formed in the nutrient medium through the action of light. If you want to avoid drying out the bacteria, wash them out with water and expose them to hanging drops. In BANGS!) Photocteinometer

1) Communications from FINSEN's Medical Light Institute in Copenhagen 1903, III, p. 97.

the cultures can be exposed to light under constant temperature conditions, and in order to avoid absorption of the light in the nutrient substrate, the bacteria are inoculated onto the surface of agar in suitable dishes.

Many authors have dealt with the question to what extent the bactericidal ability of light is or is not linked to certain spectral sections. As a result of defective technology - or direct errors in the experimental arrangement, many of them have reached incorrect results, and the following overview, given by BiE 1) and completed by me, gives a characteristic picture of how divergent views prevailed with regard to this point.

ultra-

violet

DOWNES and BLUNT 1877

FATIGATI 1879

ARLOING 1885

LUBBERT 1886

JANOWSKI 1890

SANTORI 1890 .

RASPE 1891

GEISLAR 1892 .

KOTLJAR 1892

CHMELEWSKI 1892

BUCHNER 1893

LEDOUD-LEBARD 1893

MARSHALL WARD 1893

DIEUDONNE 1894

D'ARSONVAL and CHARRIN 1894

BILLINGS and PEEKHAM 1895

KRUSE 1895

BECK and SCHULTZ 1896

FINSEN 1897

BIE 1899

TOMASCHEFSKI 1902

+-+tooo++++..totooooooo

Blue

Yellow

Red

..toil++++++++++...+......+ purple

.. toil++++++++o+tot....ot

..tool.+il+++..++o+...+...++ Green

..toiletfooli.+...+o+toil

....0+ .. tools. ttoo +....totoo......o + Orange

toilet...... +...++............+

+ denotes bactericidal resp. growth-inhibiting effect.

indicates no effect. o indicates that the type of radiation in question is not the subject of a sub

has been search.

I) Communications from FINSEN'S medical light institute in Copenhagen 1900, issue 1.

Let 's consider which considerations are to be taken and what requirements are to be made of the test arrangement in experimental investigations of the absolute or relative effect of the different spectral sections on bacteria:

Since the different types of bacteria are not equally influenced by the light, one should work with pure cultures of one and the same bacterium in each individual test series. DUCLAUX 1) was the first to introduce this improvement in his experiments. ARLOING ?) went a step further by drawing attention to the fact that spore-forming bacteria exhibit different levels of resistance in the spore stage and in the vegetative stage; it is true that he himself arrived at incorrect results as regards the greater or lesser resistance of the spores, but it is true that there is a difference and one should therefore prefer to work with a non-sporulating form, or at least for the "non- Spore formation" of the bacteria or the "non-growth" of the spores during the experiment (JANSEN 3)).

As for the water substrate, moisture ratio, etc., one should choose the most favorable for the bacterium in question, and at the same time it must be taken into account that when various culture media are exposed to light (see later), hydrogen peroxide is formed, the bactericidal effect of which is very important.

During the experiments, the temperature must of course be kept so low that it is too low for the bacteria harmful heat effect cannot be mentioned, and when using concentrated or only very strong light, the culture must therefore generally be e.g. B. be cooled by trickling water. However, it is not only necessary to prevent too high a temperature; in the case of comparative tests, care must be taken to ensure that the temperature is the same throughout the series of tests by using water baths and the like; because it seems as if the bacteria are killed more quickly by light at higher temperatures than at lower ones (SANTORI ?), KRUSE”), BÁNG 3)). It is also of some importance whether the bacteria are exposed to light in a moist or dry state (DUCLAUX"), JASSEN 5)).

The bacteria should be struck as directly as possible by the rays of light; if they are surrounded by a more or less thick layer of nutrient substrate, this will act like a protective filter by absorbing the light. It is quite reprehensible to place the cultures in test tubes or flasks during exposure; Firstly, a large part of the rays are absorbed by the glass and the nutrient medium, and secondly, the light is refracted by the convexity of the glass and concentrated towards the middle, so that the lateral parts receive almost no light. That this is indeed the case is easily demonstrated by exposing a piece of silver chloride paper to light while a test tube filled with water is held immediately in front. The paper then becomes black from

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1) Annales de Chimie et de Physique, 1885, Series 6, Tome V.

2) Comptes rendus 1885, T.CI et 1887, T.CIV.

3) Communications from FINSEN's Medical Light Institute in Copenhagen 1903, Hest IV.

the outside of the glass and on a narrow strip down the middle of the glass, while behind the sides it retains its white color (LARSEN (REYN) *, BANG?)).

11 an. dell'istit. d'igiene di Roma, II, f. 2.

2) Journal f. Hygiene 1895, XIX, p. 3/3.

3) Communications from FINSEN's Medical Light Institute in Copenhagen 1901, Issue II.

4) I.c.

5) Communications from FINSEN's med. Light Institute 1903, Issue IV.

If so many investigators have come to negative conclusions about the bactericidal nature of light, it is often because they have used light of too low an intensity. As with any antiseptic, light works: a certain degree of potency is required if it is to have any proven effect on microbes at all! – "Bacteria are not killed by light, but by strong light" (FINSEN), and one should therefore not deny the bactericidal ability of a type of radiation before experiments have been carried out with the relevant rays in the highest possible concentration.

In comparative experiments it is naturally of the greatest importance that the intensity of the light used should remain as constant as possible throughout each series of experiments, and that careful photometric determinations be made.

We return to the results obtained by many experiments on the bactericidal nature of spectral rays. It has been found that this is not peculiar to rays of a definite refractivity, but that both the ultraviolet and each of the monochromatic rays, if their intensity is sufficiently great, are capable of killing bacteria. Concerning the red rays, BIE, whose investigations in this field are the newest and best, did not achieve absolute killing of the exposed cultures, even after a 6-hour exposure (he used

1) Communications from FINSEN's med. Lichtinstitut 1900, Issue I. 2) Ibid. 1901, issue II. 3) Ibid. 1900, issue 1.

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concentrated light from a carbon lamp of 35 amperes and filtered the rays through a 0.7% solution of fuchsine): but the growth-inhibiting effect was evident after a 90-minute exposure, and it will no doubt therefore be possible, with the application of still stronger light, to kill the bacteria. What remains are the ultra-red rays, about whose bactericidal ability there are no precise studies. Various reasons speak, however, for a minimal effect of the same on bacteria. Firstly, the energy of the long-wave rays is converted to heat particularly easily, and we are completely ignoring the heat effect here; secondly, the ultra-red rays, whose frequency is next to the red ones, are less strongly absorbed by animal tissue than are the red rays (BUSCK')), and it is therefore to be assumed that their action on bacteria is also considerably less than that of the red ones is.

The Relative Bactericidal Spectral Rays.

While we are able, with the technical means currently available to us, to kill bacteria using light rays as soon as their frequency of oscillation is greater than approx. 450 trillion per second, the speed with which the different types of rays kill bacteria depends in to a very high degree on the frequency of vibration of the rays concerned. It is probable that this difference between the bactericidal action of the rays, at least for a large part, is due to an unequally strong one

1) Communications from FINSEN's med. Lichtinstitut 1903, H. IV, p. 108.

absorption of the rays is due; by analogy with other animal tissues, there can hardly be any doubt that the protoplasm of colorless bacteria absorbs the strongly refractory rays to a much greater extent than the less refractory ones, and it is therefore only fair to assume that the bactericidal action is, on the whole, related to the refractive index of the rays increases. The available experimental investigations therefore also point in this direction; but it deserves to be emphasized, that experiments of this kind constantly suffer from the difficulty connected with comparative measurements of the intensity of the different kinds of rays. As mentioned in the introduction, we have no useful common measure of the intensity of rays of unequal vibrational frequency.

The most detailed investigations into the relative bactericidal activity of the spectral rays were made by BIE in 1899. He used an electric carbon arc lamp of 35 amperes, 45 volts (approx. 6000 standard candles) as a light source. The light was concentrated using a Finsen apparatus with glass lenses and filtered through differently colored solutions, the absorption ratio of which he carefully examined qualitatively in a VIERORTS spectrophotometer. As a test subject, he used fresh Koch's plate method cultures of bac. prodigiosus in thin layers of agar.

The results of his tests are shown in the following table:

1) 1st c.

1'/]% monochromatic potassium solution

Red

% fuchsin solution

From 760 uu to 656 ueu

Distilled water

From 760 uri to 350—300 ull

All components of

spectrum

/A minute

35 minutes

1'), % solution of

quinine sulfate

From 760 mu to 418 um

3/4 minutes

80 minutes

red, orange, yellow, green,
blue and a little violet.
Volume 426-418 uu strong

2 hours

5% nickel sulfate

solution

3 minutes

From 760 uu to 418 uu

Red, orange, yellow, green, blue and some purple. Volume 426-418 and below

weak

6 minutes

From 760 uu to 499 uu

4 hours

Red, orange, and yellow

almost all green

18 minutes

1'/, double chrome

acidic potash solution

From 760uu to 541upi

Red, orange and almost

all yellow

about 9 hours

90 minutes

Not determined

Since the effect of the rays on the bacteria is inversely proportional to the killing time, the table can be rewritten as follows, which is easier to understand:

The numbers above are a relative expression of the bactericidal effect of spectral regions, all of which begin in the visible red but extend a greater or lesser distance towards the ultra-violet. The effect of certain sections inside the spectrum can be calculated by simple subtraction; if e.g. For example, if the power of the section 760 uu --- 541 uu is 5, and the power of the section 700 uu - 499 uu is 15, then the section 541 uu - 499 uu has a power of 10 - all in proportion to that passed through the fuchsin solution rays.

As Bie himself remarks, the objection can be raised against comparative investigations such as these that they do not take into account how much the rays in the various spectral sections pass through the resp. Light filters are weakened, in other words no quantitative photometric determinations have been made at the same time as the qualitative ones. It is therefore probable that the numbers found do not quite correspond to the actual conditions, but an increase in bactericidal activity with the calculation exponent within the examined spectral ranges emerges with sufficient clarity from them. Of course, no general meaning should be attached to the numbers either, since they only apply to the light from a 35 amp carbon arc lamp.

Already GEISLER') and CHEMELEWSKY ?) demonstrated a bactericidal effect in the ultra-violet part of the spectrum; but the great importance of these rays in this respect was first determined by the fine experiments previously mentioned by MARSHALL WARDS. MARSHALL WARD 3) found that the maximum for bactericidal activity was in the spectrum of an electric arc lamp, in the transition between blue and violet, but that a powerful bactericidal effect could be traced far into the ultra-violet when the light was refracted by a quartz lens. The reason that this investigator found the maximum for bactericidal activity in the blue-violet and not - like later investigators - in the ultra-violet part of the spectrum must be found in the use of Koch's plate method cultures in agar; the rays thus had to pass through a thin layer of agar before striking the bacteria, and as the ultra-violet rays are comparatively more strongly absorbed than the visible ones, a consequent displacement of the point of maximum action against the latter is understandable.

1) Central Bl. f. Bakt. 1892, XI. 2) Wratsch 1892; Ref. in Centralbl. f. Bakt. 1892, XII, p. 174. 3) lc

FINSEN proved in 1897 that the ultra-violet rays had a significantly more powerful bactericidal effect than previously thought, and he therefore replaced the glass lenses in his concentrators with quartz lenses. He states that the bactericidal activity in Focus was increased approximately 700 times by this change.

Bie), who studied the relation between the bactericidal activity in the ultraviolet and in the visible part of the spectrum of electric arc light by means of the filtration method, describes his result as follows

masses:

“ Under the circumstances under which my experiments were carried out, the effect of the ultra-violet rays, which have a wavelength of between 200 uu and 295 uu, is about 10-1 2 times as great as the effect of the whole remaining spectrum of the Beginning of red (ca. 760 uu) to the beginning of the mentioned section of the spectrum (295 m.

It is, however, clear that the filtration method cannot give entirely reliable results; for, firstly, by this method one does not obtain sharp boundaries between the spectral ranges with which one is working, and secondly, it is difficult to determine exactly to what extent the various kinds of rays have been attenuated by passing through the filters.

BANG?) resumed the investigations and, in order to obtain more exact results, as did MARSHALL WARD - refracted the light through a prism by introducing the following improved experimental arrangement. The light from an electric carbon arc lamp was refracted in a quartz prism and a shift in the spectrum formed

I) I.c.

21 Messages from FINSENS med. Light Institute 1904, Issue IX.

30

80

35

160

40L

40

45

20

0

200

ultra violet.

8

red, v

The spectrum is shown below by means of spectral lines of the same size as it had in the apparatus. RV represents the visible part of the spectrum (R

violet). So the numbers below indicate the wave widths. The numbers above indicate the distance in millimeters from the limit of the ultra-red. Numbers on the left represent kill time in minutes; the numbers on the right are the galvanometer deflections at the energy

Measurement

ABCDE kill curve. POST energy curve.

A bare screen was set up, in which there was a small cut-out for the passage of the spectral section whose bactericidal nature he wanted to examine in the experiment in question. In order to be able to work with sufficiently strong light, a quartz lens was placed behind the cut-out, which concentrated the rays, and this he now directed against a fresh agar surface culture of bac. prodigiosus. In this way, through a large number of experiments, he determined the shortest times in which the different spectral ranges could kill the bacteria. It turned out that rays with a wavelength of 300 mill 200 uu killed the bacteria fastest and 3000-4000 times faster than the blue rays.

In the adjacent curve, which according to BANG indicates the bactericidal activity in the ultra-violet part of the spectrum, a peculiar falling of the curve, corresponding to the rays of a wavelength of 330 uu - 300 uu, will be apparent. This falling does not appear to be explained by an absorption of the relevant rays in the quartz; because a corresponding fall was not observed in the bolometrically determined energy curve.

To illustrate how powerful the bactericidal power of light is, it will suffice to say that with the concentrated electric light of a lamp of 60 amperes 50 volts one is able to kill bacteria (e.g. Bac. prodigiosus) in less than a second long exposures to kill; but the cultures must then also be exposed to the rays under the most favorable conditions possible for killing.

About killing pathogenic bacteria in live animals

tissues.

!

Most of the ultra-violet rays of light are so strongly absorbed by animal tissue, even when devoid of blood, that their effect is in the top 2/10--3/10 mm. is exhausted. The penetrating ability of the blue-violet rays and the ultra-violet rays lying closest to them is significantly greater, and since they also possess a quite pronounced bactericidal activity, it must be expected that they will be able to kill bacteria even after passing through a thin layer of skin. This has also been repeatedly proven experimentally by JASSEN, among others, who killed bacterial cultures (Prodigiosus) with concentrated carbon arc light (50 Ampères), which were behind up to 1.5 mm. attached to thick pieces of skin; behind thicker layers of skin it was not possible to completely sterilize the cultures, but a clearly weakening effect on the bacteria was noticeable even through 4 mm thick skin.

It has been of interest, with a view to practical phototherapy, among other things, to investigate the extent to which bacteria can be killed by light when they are surrounded by and growing in living tissues.

NAGELSCHMIDT?) demonstrated this with regard to the tubercle bacilli by exposing artificially induced skin tuberculosis in guinea pigs. Immediately after exposure - before the light reaction could develop in the tissue - the exposed areas of the skin were excised and inoculated intraperitoneally into guinea pigs. Only 1 out of 8 animals so vaccinated developed tuberculosis, while all control animals (30) developed attack. To all appearances it turned out to be an extremely superficial tuberculosis.

1) Communications from FINSEN's med. Light Institute 1903, Issue I\'. 21 Archive f. Dermat. & Syphilis 1902, Vol. LXIII.

I myself conducted a similar experiment with virulent pneumococci by inoculating interlamellarly into the cornea with these 18 guinea pigs and rabbits; four hours after vaccination, I exposed the eyes of half of the vaccinated animals to rays from a BANGS iron lamp for 20 seconds. In the nine unexposed corneas, severe inflammation with grey-white infiltration developed in the course of the first day, while the exposed ones -- with a single exception - remained completely unaffected. So the light can undoubtedly kill bacteria if they are close to the surface. - In practical phototherapy, however, the "light reaction" caused in the skin is certainly of the greatest importance.

The relative resistance of different forms of bacteria.

Several authors have attempted to answer the question to what extent there is or is no difference between the resistance of the various types of bacteria to the harmful influence of light. (DUCLAUX"), GAILLARD 2), BUCHNER3), BILLINGS and PEEKHAM), DIEUDONNÉS) and others).

I) Ann. de l'Institut PASTEUR 1887.

2) GAILLARD, De l'influence de la lumière sur les microorganismes. These de Lyon 1888.

3) Central Bl. f. Bacteriology 1892, XI-XII.

4) Science News 1895, I, p. 169.

5) Work on the quays. society 1894, IX. Notices a. Finsens Medical Light Institute. vii

The most detailed investigations in this area have been made by A. LAREN (REYN)). It emerges from these that:

1) the different species of bacteria are affected differently by light, and there can be an important difference even between very closely related species.

2) The time it takes to kill a species of bacteria is not in constant proportion to the time it takes to weaken it.

Above graphic representation of each

6) Notifications from FINSENS med. Light Institute 1900, Issue I.

weakened.

(Time in seconds.)

B. typhi muris

B. coli commune

B. Typhi

Staphyl. pyog. citerus

Staphyloc. pyogenic. albus

Staphyloc. pyog. aureus

B. pyocyaneus

B.cyanogenus

5 10 15 20 25 30 35 40 45 50 55 60

Experimental results gives a good overview of the relative killing times of the bacterial species studied.

Bang found about the same kill time for the tubercle bacilli as for Staphylococcus pyogenes aureus.

Can the light kill all types of bacteria? All the forms studied so far can be killed by strong light even in very short periods of time, and it would therefore be unjustified to assume that any of the unstudied ones should be in possession of an absolute resistance to light, all the more so since light affects not only bacteria, but detrimentally affects almost all living organisms, if its intensity is sufficiently great, and if the organisms are not in one way or another - e.g. B. by a pigment layer

against the light. be protected. The mention of a few examples will suffice to show this killing or at least harmful effect of intense light on all living organic tissue (see page 117 and following).

The resistance of bacterial spores to light.

Bacterial spores are known to be significantly more resistant to heat, desiccation, and chemical antiseptics than the corresponding vegetative forms; JANSEN has proved that this also applies to their relationship to light through a series of careful tests carried out in the FINSENS laboratory. The earlier investigators in this field had come to quite contradictory and uncertain results, mainly because all their experiments were carried out with too weak light (unconcentrated sunlight); the exposure times had to be long as a result, and it was not always possible for the spores to grow out during exposure (ARLOING 2), GAILLARD 3), RASPE"), KRUSE"). In order to avoid such germination, some authors (DUCLEAUX) , PANSINI"), MOMONT"), KRUSE")

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1) Communications from FINSEN's med. Light Institute 1903, Issue IV.

2) Compt.rend. de l'académie des sciences 1885, Tome CI et 1887, Tome CIV.

3) I.c.

4) RASPE, On the influence of sunlight on microbes. - Inaug. Diss., Rostock 1901.

5) journal f. Hygiene 1895, XIX.

6) Compt. ren. de l'acad. des sciences 1885, T.C et CI.

7y kef. by LEREDDE et PAUTRIER, Phototherapie et Photobiologie, Paris 1903.

8) Ann. de l'Institut PASTEUR 1902, VI.

9) 1.c.

Experiment with dried spores. As JANSEN points out, however, the killing times of the same may only be compared with dried vegetative forms; but since desiccation is in and of itself considerably more injurious to the bacilli than to the spores, these investigations also give no reliable result.

For his experiments, JANSEN used partly concentrated, partly unconcentrated light from an electric arc lamp of 50 amps. The longest exposure times were in the unconcentrated light: 21 minutes and in the concentrated: 5 minutes. Since the temperature was kept below 20° during the exposure times, it can be assumed that the spores did not germinate.

The result of these tests was the following:

1. The spores of bac. anthracis are 5-6 times more resistant to light than the bacilli.

2. The spores lose some of their specific resistance as soon as they start to germinate, even at a time when no significant change is seen.

3. The dried spores of bac. anthracis are no more resistant (as MOMONTS and KRUSES studies indicate) than the moist ones, and after long periods of desiccation they are undoubtedly less resistant.

4. The bacterial spores are affected by the ultra-violet rays relatively as much as the bacilli.

In a special series of experiments it was found that the spores of bac. subtilis was about 7 times more resistant to light than the corresponding vegetative forms.

On the importance of age, temperature and habituation

for the resistance of the bacteria.

On exposure of a series of surface cultures of this or that species of bacteria to sufficiently intense light for a series of unequal lengths of time, the bacteria in the dishes which have been the subject of only a short exposure, after remaining in the thermostat for 24-48 hours, become perhaps quite as absolute unexposed cultures are fully grown; slightly longer exposure causes the bacteria to grow more slowly, and with still longer exposure times, there is a dilution indicating that some of the bacteria have perished; afterwards dishes with fewer, finally only with single colonies follow, until finally one arrives at dishes in which all bacteria are killed by the light.

What is the cause of this often very significant difference between the killing times of the individual bacteria?

The difference occurs even when using a comparatively young culture, filtered through glass-wool and diluted with distilled water immediately before inoculation; this procedure avoids the formation of single larger clusters of bacteria on the agar surface, the most distant individuals of which would be covered by the preceding ones, and thereby provide protection against the rays of light. However, it is of course unavoidable that some bacteria are completely or partially covered by others and several factors suggest that this is the reason for the gradual destruction of bacteria. Bie') writes as follows in his work on the action of light on bacteria: "Among my numerous experiments I have constantly observed that when a culture is exposed to electric light containing the extreme ultra-violet rays, its power of resistance changes, from Vibrating trial after trial, and the perishing of each individual at different times becomes more apparent than when the light is deprived of these rays by passing through glass. In such a case one sees that after an exposure which is only somewhat shorter than is necessary to kill all the bacteria, there are still numerous living individuals distributed over the entire exposed spot. This never happens when the light contains many ultra-violet rays; in such a case the ratio becomes a very gradual annihilation of the bacteria, and long after the great majority of bacteria have been killed, single living individuals are still found, only very slowly decreasing in number. This difference between the effect of high-ultraviolet and low-ultraviolet light is certainly not based solely on a greater variation in the ultraviolet radiation development of the lamp compared to the development of the other types of radiation. The main reason is certainly a preferential influence on the ultra-violet rays by the slightest hindrance to the passage of light, e.g. B. a small ambiguity or a row of bacteria in a row."

In connection with this it should be mentioned that the absolute killing time for a surface culture increases with the number of bacteria per surface unit.

The question is still open whether the resistance to light is not also found in the bacteria in

1) Notifications from FINSENS med. Light Institute 1904, Issue VII.

one and the same culture can be individually different, and the investigations carried out by BANG 1) on the importance of the age of the culture for the resistance of the bacteria seem to be applicable in the sense of this view. Regarding Bac. prodigiosus, BANGS experiments showed an increase in resistance to light with the age of the culture, so that 12-hour-old cultures require 5-6 times as long exposure times for sterilization as 3-hour-old cultures. Since the greater resilience in the older Prodigiosus cultures could perhaps be due to the increased pigment formation which, as BANG himself points out - can possibly have a protective effect, I have the ratio in the uncolored Bact. coli commune examined. In six series of experiments in which I used BANGS photocteinometers, I found no significant difference between the killing times of bacteria that

20 hour old and 4 hour old cultures.

TOMASCHEFSKI) investigated the same relationship regarding Staph. pyog. aureus and he also did not succeed in demonstrating any increased resistance in bacteria from older cultures. The same author also criticizes the principle side of the question: the terms young or old culture do not say anything about the age of the bacteria, it is only a question of their shorter or longer stay in one and the same nutrient medium.

At the same time I want to discuss some other conditions which may be of importance for the greater or lesser resistance of the bacteria. BANG 3) examined,

, I) Averages from FINSENS med. Light Institute 1901, Issue II.

2) Works from the light department in the clinic of Prof. WELLIERMINOFF by KP SERAPIN 1902, vol. I. (Russian.)

3) I.c.

from

was.

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to what extent the effect of light increases with rising temperature, which some experiments by SANTORI) and KRUSE 2) had already indicated, and he found that Bac. prodigiosus is killed faster at 450 than at 30°, while no constant difference between the killing times of cultures illuminated at 30° and at 15° has been demonstrated

It should be added that Bac. prodigiosus, as shown by the control experiments, does not suffer any visible damage when exposed to a temperature of 450 in such a short period of time as is required for the exposures. A heat effect harmful to the microorganisms can hardly be completely ruled out, despite the control experiments. As early as 1891, MARTINAUD found that yeast cells (Saccharomycetes) were killed more quickly by light at 41–45° than at a lower temperature. An increase in the effect of light with increasing temperature agrees well with the fact that most chemical processes take place more easily at higher than at lower temperatures.

BIE 3) found that a small degree of habituation to the light can take place, so that the resistant. susceptibility to it increases when the cultures are in comparatively weak light. He sums up his investigations in the following 3 theses:

1. By keeping a number of successive generations of Vibrio Metchnikovi broth cultures in diffused light, the bacteria obtained a small increase in their resistance to concentrated electric light, which had approximately the same composition as sunlight, by being replaced by a 1,2 mm thick piece of glass and an approx. 0.3 mm thin layer of agar. The culture which stood in daylight was compared with a culture which had stood in the dark for 3-5 months but under otherwise the same conditions as the light culture; they were both usually inoculated daily in fresh broth. The increase in resistance was approximately equal whether the culture had been exposed to light for 1-2 days or 3-5 months.

1) cit. after BANG. 2) I.c. 3) BIE, Om Lysets Virkning paa Bacterier, Kobenhavn 1903.

2. A similar degree of habituation was achieved by exposing a number of generations of Vibrio Metchnikovi in broth to concentrated electric light daily for increasing periods of time from 10-60 seconds.

3. A broth culture from a Vibrio Metchnikovi. Cultures exposed immediately after inoculation to concentrated electric light for a time nearly killing the bacteria had reduced resistance.

However, the difference between the resistance of light and dark cultures in Bie's experiments was so small that it is possibly within the experimental error limits. In a series of experiments of a similar nature I obtained negative results with B. prodigiosus; but my experimental arrangement was certainly also somewhat different from that used by Bie. I exposed recently prepared agar surface cultures to the unconcentrated light of a 60 amp electric arc lamp. The exposure interval was 1 m and the exposure time was so long (about 7 minutes) that the culture was approximately sterilized so that after standing in the thermostat only single, scattered colonies grew. From one of these cultures I inoculated into broth, and the following day I used this broth culture for a new agar surface culture, etc. For two months I maintained the culture, thus consistently selecting the most resistant bacteria. In subsequent comparative exposure experiments I could demonstrate no significant difference in killing time between this culture and a second which had been kept in the dark and inoculated from bouillon to bouillon every other day.

On the importance of the intensity of light.

A question that often comes to the fore in light-biological investigations is to what extent a long-lasting exposure to relatively weak light has the same effect as a short but intense exposure; In other words, whether the photobiological effect is always the same if only the product of light intensity and exposure time is constant.

One can assume from the outset that this only applies within certain limits; because from a biological point of view, quantitatively different exposures can result in qualitatively different effects; weak light can e.g. B. have a useful effect where strong light may have a destructive effect, and for all biological processes that are influenced or conditioned by light, there is an optimum exposure with a fall on both sides. However, within certain limits, the rule sometimes seems to be applicable, e.g. B. in the killing effect of light on bacteria. Assuming that the light from an electric lamp is attenuated with the square of the distance from the crater, the killing time for bacteria should be e.g. B. at a distance of 60 cm., so four times as long as the killing time at 30 cm. distance, and this has also proved to be approximately correct in BANGS photocteinometer tests. Some determinations made by myself of the killing times of diphtheria bacilli at various distances from an electric carbon arc lamp also confirm the accuracy. It goes without saying that the distance from the lamp should not be chosen too great, for the absorption of the short-wave rays by the air layer will then begin to play a part, apart from the fact that at a certain distance the light becomes so weak that it does not get through at all Is able to kill bacteria.

The disinfecting effect and hygienic importance of the

sunlight. While the use of concentrated electric light in experiments on the bactericidal nature of light offers such great advantages in terms of greater intensity and uniformity that it is generally preferable, there is a special interest in experiments in which the sun is used as the source of light insofar as these experiments give one a very direct impression of the role played by sunlight in relation to hygiene.

DIEUDONNÉ), starting with bac. prodigiosus and Bac. fluorescens and in some experiments with Bact. coli commune, Bac. typhi and Bac. anthracis found that direct sunlight during the summer months overcame the bacteria

1-11/2 hours to kill, while about 5 hours are required in diffuse daylight. About the wax

from

1) Work on the quays. Ges. 1894, IX.

To visibly inhibit tum was necessary about half the time. FINSEN 1), working with Koch plate method cultures in Nielsen flasks, achieved (around 12 noon in August in Copenhagen) marked attenuation of the growth of the cultures after a 15 minute exposure, and absolute killing after about 1") , hour exposure, although the light had to pass through the glass wall of the bottle and a thin layer of agar before it hit the bacteria.

It goes without saying that the bactericidal ability of sunlight varies with its intensity, i.e. with the seasons and times of the day, with the geographical location of the place, with the current weather conditions, etc., and the above-mentioned time information can therefore not claim to be universally valid; but you get an impression of the enormous influence that sunlight must have in nature with regard to cleaning the air, the surface of the earth and the water in rivers and lakes from microorganisms.

The so-called "self-purification" in rivers, where the water becomes comparatively pure and low in bacteria within a few miles of large towns whose sewers have their outlets in the river, is probably due in large part to the sedimentation of the solid matter, but that Undoubtedly, sunlight also plays a major part in this.

The investigations of DANDRIEUS?), BUCHNER S 3) FRANKLANDS), MARSHALL WARDS"), PROCACCINIS") and other researchers illuminate these relationships in detail.

1) FINSEN, Om Anvendelse i Medicinen af koncentrerede kemiske Lysstraaler, Köbenhavn 1896.

2) Ann. d'Hygiene 1888, p. 448.

3) Arch. f. Hygiene 1893, XVII, p. 179.

4) Central Bl. f. Bakt. 1894, XV, p. 101.

5) Proceedings of the R. Soc. of London 1894, LVI, p. 315.

6) Ref. in BAUMGARTEN's annual report. 1893, IX, p. 576.

It has been shown that the bacterial content of the sea is lowest at the surface and increases sharply with depth. BASSENGE!) found in a series of investigations carried out on a trip to the tropics that sea water contained 1000 times more germs at a depth of 10 meters than on the surface. This only applied when the weather had been calm for a long time; in turbulent weather with heavy seas such a difference could not be demonstrated. SCHMIDT-NIELSEN 2) carried out similar investigations in Dröbaksund (Norway). At a depth of a few meters he found about twice as many germs as on the sea surface, and at a depth of 10-25 m the average number was 10 times as large. FISCHER) considered this ratio to be a result of the inhibiting influence of sunlight on bacterial growth. Perhaps the gravitational effect is also of some importance, but the very important difference between BASSENGES' and

SCHMIDT-NIELSEN's numbers speaks for FISCHER's view, in that one must expect from the outset a significantly stronger light effect in the tropics than high up in the temperate zone.

In addition, in Lake Starnberg near Munich, the bactericidal ability of light itself has been experimentally demonstrated several meters below the surface of the water. Gelatin cultures in PETR dishes were lowered into water and exposed to the action of sunlight for 4½ hours; although the trial took place in September, it turned out that the light

1) cit. according to FISCHER: The bacteria of the sea.

2) Biological Centralbl., February 1901, vol. XXI, no. 3.

3) The bacteria of the sea. (Results of the Plankton Expedition of the HUMBOLD Foundation, Vol. II mg)

had sterilized the shells to a depth of 1.60 m., and even at a depth of 3 m. the cultures were arrested in their development. The unequal distribution of bacteria at different depths of the sea may also be due to negative phototactic or photopathic movements, and a study of the amount of bacteria on the sea surface at different times of the day would be of significant interest in this connection.

Wrrrlin 1) found that street dust could be disinfected by exposure to direct sunlight, and ESMARCH?) also demonstrated the disinfecting effect of sunlight in various ways.

It will be seen from the examples given that the importance of sunlight for hygiene

2. B. large, densely populated cities cannot easily be overestimated, and one has to agree with DUCLAU'X 3) when he writes: “La lumière solaire est l'agent d'assainissement à la fois le plus universel, le plus economique et le plus actif auquel puisse avoir recours l'hygiène privée ou publique."

How can the bactericidal effect of light be explained?

Is the bactericidal ability of light due to a direct effect on the bacteria - in other words, are they killed by the light causing chemical changes in their protoplasm - or is it due to an indirect action through the development of a bactericidal substance in the growing medium?

1) Wiener clin. weekly 1896. 2) Journal. f. hyg. and infection. 1894, XVI, p. 257. 3) Compt. ren. ds de l'académie des sc. 1885, T. CI, p. 395.

Roux 1) showed in 1887 the impossibility of outgrowth of anthrax spores in broth if it had been exposed to sunlight for 3-4 hours immediately before vaccination. The spores, however, were not killed; even after standing in the lighted broth for 12 days, they germinated well as soon as he transferred them to unexposed broth. If he inoculated adult anthrax bacteria in broth that had been exposed to light for the same length of time, they grew luxuriantly. If the bouillon was left in the dark, the ability to prevent the germination of the spores was gradually lost.

MARSHALL WARD), CHMELEWSKY 4), JANOWSKI 5), GEISLER"), BUCHNER), BILLINGS and PEEKHAM"), DIEUDONNÉ), FRANKLAND 19). Numerous investigations have yielded quite varying results, among other things certainly because of the use of insufficiently intense light (e.g. direct sunlight), but it seems to emerge from these investigations that when different nutrient substrates are exposed to light, a substance develops in them which has a harmful effect on bacteria.

RICHARDSON 11) stated in 1893 that hydrogen peroxide was evolved when urine was exposed to light and he asserted that it was probably this substance and not the light directly that killed the bacteria. DIEUDONNÉ 1) continued these experiments and also demonstrated the formation of hydrogen peroxide in gelatine and agar when these substances were exposed to "chemical" rays in the presence of air ɔ: in the presence of oxygen. From his experiments he draws the conclusion that the formation of hydrogen peroxide through the action of air and light is of not insignificant importance for the bactericidal ability of light.

1) Ann. de l'Institut PASTEUR 1887, I, p. 174.

2) Ann. de l'Institut PASTEUR 1892, VI, p. 593.

3) Proceedings of the Royal Society of London 1893, Vol. LIII.

4) W'ratsch 1892, no. 20. Ref. in Centralbl. t. Bakt, 1892, XII, p 174.

5) Central Bl. f. Bakt. 1890, VIII, p. 167.

6) Central Bl. f. Bakt. 1892, XI, p. 161.

7) Archive for Hygiene 1893, XVII, p. 179.

8) Science 1895, p. 169. Rel. in Centralbl. f. Bakt. 1896, XIX,

p. 244.

9) Work on the quays. Ges. 1894, IX.

10) Central Bl. f. Bakt. 1894, XV, p. 101.

n) Journal of the Chemical Society 1893, LXIII, p. 1109.

KRUSE?) came to the conclusion that a toxic substance other than hydrogen peroxide plays a role in the growth of bacteria in the exposed culture media, and that the light alone does not bring about a change in the medium. calls, but also acts directly on the bacteria.

The latest and most precise investigations in this area come from BiE 3), who summarizes his results in the following points:

1. Exposure of broth to sunlight or concentrated electric arc light produces a substance which inhibits the germination of anthrax spores. (A confirmation of Roux's experiments.)

2. By applying sufficiently strong, concentrated electric light, this substance is developed in such large quantities that bacteria (Bac. prodigiosus) which have been sown in broth after exposure to light perish.

3. The bactericidal substance is formed on exposure to bouillon, urine, and peptone solution, but not to exposure to Uschinsky's liquid, horse scrum, or peptone solution containing lactic acid.

4. The bactericidal substance will disappear from the broth upon standing.

1) I.c.

2) journal f. Hygiene and infection. 1895, XIX, p. 319.

3) BIE, Om Lysets Virkning paa Bacterier, Kobenhavn 1903. Communications a. Finsens Medical Light Institute. viii

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5. Hydrogen peroxide is formed on exposure of meat broth with 1/2% sodium chloride, bouillon, peptone solution or urine, but not on exposure of distilled water, peptone solution containing lactic acid of soda, Uschinsky's liquid, horse serum or solutions of dextrose, cane sugar, ammonium chloride or ammonia oxalate . Hydrogen peroxide is therefore formed only in liquids which contain compound organic nitrogen compounds; its formation is prevented by reducing substances (lactic acid soda).

6. The amount of evolved hydrogen peroxide increases with the light intensity and the strength of the solution.

7. Hydrogen peroxide is not formed in a peptone solution from which the oxygen has been expelled.

8. The evolution of hydrogen peroxide is due to the action of chemical rays of light.

9. The extreme ultra-violet rays, which are not

9 able to penetrate glass and contribute only to a small degree to the development of hydrogen peroxide.

10. The hydrogen peroxide disappears from the broth on standing.

11. Since the in 1.-4. The bactericidal substance mentioned requires the same conditions as hydrogen peroxide for its formation, and since both substances disappear on standing, I have concluded from my experiments that these two substances are identical.

12. The bactericidal substances in the serum are destroyed by light.

13. Bacteria (Bac. prodigiosus), even when the liquids are uniformly stained with caramel, are more quickly killed by light when they are slurried in distilled water or 5% grape-sugar solution than when they are slurried in bouillon or 5% peptone solution. Since at exposure of

Since no chemical process can occur in distilled water, it can be concluded that the bactericidal effect of light does not depend on the formation of a bactericidal substance in the liquid in which the bacteria are, but that it results from a direct effect on the bacteria exists.

If, then, the bactericidal power of light is due to a direct action on bacteria, what might this consist of? The question has occupied many researchers, and all of them have focused their attention on whether it is an oxidation process or not, in other words, whether light can kill bacteria only in the presence of oxygen.

LEDOUX-LEBARD) and BUCHNER?) found that the presence of oxygen in the light was completely irrelevant for killing bacteria. Downes and Blunt ?), DUCLAUX"), Roux), GAILLARD"), Tizzoni and CATTANI), KRUSE") and DIEUDONNÉ) obtained the completely opposite result: that the presence of oxygen is a necessary condition for the bactericidal effect of light. Finally MOMONTS 10) and KEDZIORS 11) investigations indicate that the light probably bacteria in the vacuum or

1) Arch. de Médic. expérimentale et d'Anatomie pathologique 1893, V, p.779.

2) I.c.

3) Proceedings of the Royal Soc. of London 1878, XXVI 11. 1879, XXVIII,

can kill in an indifferent species of air, but the bactericidal ability is greatly increased when oxygen has access to the bacteria. This last view is confirmed by BIE"), who recently carried out a series of investigations with the following results:

1. The bactericidal action of light is not an oxidizing process in the sense that the presence of oxygen is a condition for it. This is because the light can kill bacteria even when every trace of oxygen has been removed and when no new oxygen can be formed by decomposition of chemical substances during exposure.

2. When the light contains the extreme ultra-violet rays of electric arc light, which can only pass through rock crystal but not through glass, its bactericidal action is only slightly dependent on the presence of oxygen.

3. The points mentioned under 2 apply regardless of whether the bacteria have dried up or have been suspended in distilled water, or whether they are lying on the surface of a moist agar plate.

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4) Ann. de Chimie et de Physique 1885, V, p. 57.

5) I.c.

6) GAILLARD, De l'influence de la lumière sur les microorganismes. Thesis. Lyons 1888.

7) Archive for exper. pathol. and Pharmacol. 1891, XXVIII, p. 58.

8) I.c.

9) I.c.

10) Ann. de l'Institut PASTEUR 1892, VI, p. 21.

11) Archiv f. Hygiene 1899, XXXVI, p. 323.

4. The difference between the resistance of bacteria in hydrogen and in atmospheric air becomes greater when the light is deprived of the extreme ultra-violet rays by passing through glass.

5. The difference becomes very marked when the light, besides the extreme ultra-violet rays, is deprived of a part of the remaining chemical rays by passing through both glass and a layer of agar.

6. The fewer chemical rays the light contains, the more the bactericidal effect seems to depend on the bacteria having access to oxygen. The ability of light to kill yeast and mold.

1) I.c.

Various authors (Downes and BLUNT'), GAILLARD?), LAURENT 3), ELFVING 4), MARTINAUD 5), MARSHALL WARD 6) have investigated the killing effect of light on fungi; there are, however, significant discrepancies between their results, and the cause of this is, among other things, the use of relatively weak light (sunlight). Such investigations are, of course, of great interest in several other respects, but they give no explanation as to how far the fungi in question can or cannot be killed by light at all.

Using the electric light of a 45 ampere lamp concentrated by a FINSEN apparatus, BiE succeeded in killing all the species of fungus with which he worked.

Saccharomyces apiculatus was killed in 5 minutes but not in 4 Monilia candida

5

4 Torula

25 Cladosporium

» , 25 Aspergillus niger

75

99

90

99

99

For comparison it can be stated that Bac. prodigiosus is killed under the same conditions in the course of about 1 minute and is visibly weakened with an exposure of ")-1 second.

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1) Proceedings of the Royal Society of London 1879, XXVIII, p. 199.

2) I.c.

3) Cit, after ELFVING.

4) ELFVING, Studies on the Effects of Light on Fungi, Helsingfors 1890, p. 105.

5) Compt. ren. de l'Acad. des sciences 1891, CXIII, p. 382.

6) Proceedings of the Royal Society of London 1893, LIII, p. 23.

7) Notifications from FINSENS med. Light Institute 1900, Issue I.

The yeasts and molds studied are therefore significantly more resistant to light than the bacterial species studied so far, and the resistance is significantly greater in the pigmented (Torula, Clodosporium and Aspergillus niger) than in the non-pigmented forms (Saccharomyces apiculatus and Monilia candida).

The killing effect of light on infusoria.

Infusion animals are excellent candidates for light biology studies because they can become the subject of direct microscopic observation immediately after or even during exposure. According to TOMASCHEFSKIS ') and DREYERS 2) investigations, very short exposures to strong electric light have an inciting effect on the movements of the infusoria; but if the exposure is continued, the velocity of the movements decreases again, and finally ceases altogether, leaving only very weak flickering and vacuole contraction. The originally linear movements change their character beforehand, in that compulsory circular movements occur, which in turn are replaced by a rotation around the axis of the animals. Most forms then contract spherically with a sharply demarcated membrane; finally this bursts and the protoplasm escapes. Exposing the infusoria to the simultaneous action of light and various toxins, GRETHE 3) and ULLMANN 4) found similar premortem changes, and I myself observed the same phenomena when I caused the death of the infusoria under the microscope by gradually heating the slide. The changes described therefore do not appear to be peculiar to photokilling. If the exposure is stopped early enough for the animal to survive, the shape change can persist for a few days.

1) Works from the lighting department of Prof. WELLIERMINOFF's clinic by KP SERAPIN 1902, vol. I, p. 260. (Russian.)

2) Notifications from FINSENS med. Light Institute 1904, Issue VII.

3) Cit. by ULLMANN.

4) ULLMANN, About the effects of electric arc light on microorganisms in the presence of fluorescent substances. Diss., Munich 1901. *) I have found a very similar relationship with interrupted exposures of bacterial cultures,

DREYER also found that a number of light effects can be summed up, if not more than a few

about 5

Minutes elapse between each exposure, so the result becomes the same as a continuous exposure in the added time*).

The time of killing varied greatly for the different forms and, curiously, was independent of the size of the animals and the degree of pigmentation. They were all killed faster by the more refractory beams than the less refractory ones.

A kind of after-effect takes place, so that on examining a drop of infusoria one hour after exposure one finds a greater number of dead ones than immediately after exposure.

Other examples of the killing ability of light.

The light can also kill organisms with a larger and more complicated physique than those mentioned so far, provided its intensity is sufficiently great. Both eggs and recently hatched larvae of the common disc snail (Planorbis) are e.g. B. in

concentrated carbon arc light within minutes.

Frog larvae, according to my own research, require a little longer; because partly because of the size of the body, partly because of the strong, black pigmentation, only the side of the animal facing the light is affected; here, however, such drastic changes occur (reactive inflammation, shedding of the epithelium, etc.) that they lead to the death of the animal. I have shown through the following experiments that this is particularly an effect of the ultra-violet rays: tadpoles about 1 cm long were placed in small water-filled chambers; As a cover I used sometimes ordinary cover glass, sometimes small quartz plates, and through these I exposed the animals to the light of a carbon arc lamp of 60 amperes, 50 volts, concentrated by a Finsen apparatus. At the same time, I sprinkled cold water over the lid to neutralize the effect of the heat rays. The tadpoles exposed behind glass were found to swim vigorously and suffered no detectable damage even after exposure for 40 minutes. Behind quartz, the animals also behaved vigorously for the first minute, but after 1-1/2 minutes they stopped moving and lay quietly on the floor of the chamber. After exposure for three minutes, microscopic examination showed that blood circulation had stopped. It is clear from the experimental design that the death was not due to any thermal effect but was due to the ultra-violet rays which pass through quartz but are absorbed by glass. In agreement with this are the results of other experiments, in which I killed with iron arc light from Bang's lamp (8 amperes).

1.7 cm long frog larvae obtained with a 5 minute exposure at a distance of 4 cm from the lamp; in these last experiments the possibility of an adverse heating effect was also completely ruled out.

Exposure of larger animals to highly refractory rays can produce an inflammatory condition in the skin, as will be discussed in more detail in a later section. If such an inflammation is sufficiently intense and covers a very large area of the skin, it must be assumed that it may, at least secondarily, result in the death of the animal.

It is a completely different question whether the light can directly kill the tissue cells as such. In the modern light treatment of lupus vulgaris (FINSEN), a very intense light is applied to each individual lupus spot for about 75 minutes, often the same spot is even treated in two consecutive sessions without necrosis of the tissue ever being observed. However, it must be considered likely that this can occur with even more extended light intensity and exposure time. - The question to what extent a direct elective killing of pathological cells in the lupus-infiltrated tissue takes place with this treatment is still open; Histological tissue examinations before and after the light treatment have so far revealed nothing definite in this regard. The sometimes extreme and rapid formation of vacuoles in the granuloma cells, which GLEBOWSKI") and WANSCHER 2) found in light-treated lupus tissue, seems to speak in favor of such a direct killing.

1) Ref. of SERAPIN in: Negotiations of the German Dermatological Society, Breslau 1901.

2) Communications from FINSEN's med. Light Institute 1904, Hest VII.

According to OGNEFF 1), perforation can be caused by exposure of the cornea of frogs to ultra-violet rays, and this then occurs without any preceding, macroscopically visible inflammatory phenomena in the tissue. I myself exposed a considerable number of frog corneae to intense iron-arc light without ever being able to observe such a perforation; on the other hand, in contrast to OGNEFF, I found changes very similar to those which occur in the cornea of mammals (rabbits, guinea pigs) after exposure to ultra-violet light (see later); only in the frogs a longer exposure time was required and the obscuration was only visible after 4-7 days, circumstances which indicate that the ultraviolet rays are absorbed less strongly by the cornea of frogs than that of mammals. Shedding of the corneal epithelium, on the other hand, is a very common result of exposure, both in frogs and in mammals.

Direct proof of the ability of light to kill tissue cells was provided by JENSEN and JANSEN?) through their joint investigations into the effect of light on pathological cells. Excised portions of a cancerous tumor found in white mice were exposed in very thin layers to concentrated carbon arc light, and it was found that they thereby lost their former ability to induce tumor formation in healthy mice after inoculation.

However, cell killing can be made even easier using ciliated epithelial cells as objects of study

I) PFLÜGER's archive for the entire physiology 1896, vol. XXXVI,

p. 209.

2) Communications from FINSEN's med. Light Institute 1904, Hest VII.

be demonstrated. It is well known that, under favorable circumstances, ciliated movement can continue long after the cell in question has been torn from the mucous membrane in which it has been housed, and even after the cell has been damaged in various ways. In other words, it seems as if the ciliated movement is generally the longest-lasting form of visible manifestation of life in the cells concerned, and that its cessation may therefore be regarded as tantamount to the death of the cells. I exposed such cells, originating from the mucous membrane of the esophagus or from the tongue of frogs, to the concentrated carbon-arc light of a lamp of 60 amperes, 45 volts, taking care to exclude any harmful effect of heat by sprinkling them with cold water. After a 5--10 minute exposure, depending on the size of the cell cluster, microscopic examination revealed that the fibrillation motion had definitely stopped.

Concerning plant cells, PRINGSHEIM 1) showed a number of years ago that they can be killed by concentrated sunlight without the intervention of heat rays being necessary. The effect of the light emerges macroscopically very nicely, when one or the other leaf is covered I have e.g. B. Virginia creeper leaves are used—with a piece of paper in which a cross or the like has been cut out, and the leaf is exposed to concentrated electric light, with a sprinkling of cold water. After just 15-30 minutes of exposure, the sheet will be discolored in a spot which is exactly the same as that on the paper

I) Monthly report i.e. royal Prussia. Acad. d. scientific on Berlin, 1881, pp. 504-534.

cut, and by the day after exposure the spot will be dried up and wilted while the remainder of the leaf continues to be fresh and green. I have also been able to kill whole plants (young buckwheat plants, for example) by exposing them for an hour to the rays of an 8-ampere iron-arc lamp. - The perishing of the cells is mainly caused by the strongly refractory rays.

Light development in microorganisms. As is well known, it is not uncommon for various organic substances, e.g. B. Meat and fish (especially often saltwater fish) emit a more or less strong phosphorescent glow as they begin to decompose, which is of course most obvious in the dark. PFLÜGER 1) was the first to understand this peculiar phenomenon as a rash for the vital activity of the microorganisms. After him, a number of authors (LUDWIG2) FISCHER 3), BEIJERINCK), KATZ), GIARD) and others) bred and described a large number of self-luminous bacteria, and FISCHER drew attention to the fact that the bog glow was also a bacterial phosphorescence*). explain is.

1) PFLUGER's archive for the entire physiology, vol. X, p. 275 and vol. XI, p. 222.

2) journal f. Microscopy, Vol. I.

3) journal f. Hygiene and Infectious Diseases, Vol. II and Centralbl. f. Bacteriology, Vol. III.

4) Ref. in Koch's annual report. 1890, p. 180.

5) Central Bl. f. Bacteriology, Vol. IX.

6) Ref. in Centralbl. f. Bacteriology, Vol. VI.

*) However, moor lights can also be used by other self-illuminating organizations. nisms, e.g. B. be caused by peridiniums.

The light emitted by the different species varies greatly in intensity, as can their color: white, bluish or greenish. In a spectroscopic investigation, FISCHER) found a continuous spectrum from the D line to a little beyond the G line in one species, with an intensity maximum between E and F. - The phosphorescence can reach such a strength that when it shines z. B. reading the position of the hands on a clock is possible; one has even been able to photograph cultures of phosphorescent bacteria with the light emitted by themselves, and the quite astonishing strength and extent which the bog glow can have in tropical waters has often been the subject of description.

Of the conditions necessary for the phosphorescence of the bacteria, the first to be mentioned is the free access of oxygen. Cultures in solid media only glow on the surface, while flowing cultures can be made to glow over their entire extent by shaking with atmospheric air. The temperature of the surroundings can also influence the luminosity of the bacteria, in that both particularly low and particularly high temperatures prevent fluorescence, even if the bacteria can continue to live. The limits are quite broad and depend, among other things, on the temperature at which the bacteria in question tend to live. FORSTER?) bred z. B. a salt water bacterium, which retained the ability to glow and multiply if he cultured it at 0°, and TOLLHAUSEN 3) even has a glowing bac

to

I) 1. c.

2) Central Bl. f. Bacteriology, Vol. II, p. 337.

3) Studies on Bacteria phosphorescens FISCHER. Diss., Würzburg 1889.

culture culture can cool down to - 120 without complete cessation of phosphorescence.

It has been shown that all luminous bacteria require a fairly high NaCl content in the culture medium in order to be able to produce light at all. Sea water is therefore particularly suitable for preparing such nutrient substrates.

There are 2 theories for the light development of bacteria:

1. The development of light is a direct function of the living protoplasm and is therefore inseparable from it, just like the heat effect.

2. The living cell produces and excretes a substance (photogen) that glows extracellularly.

DuBois 1) even claims to have found such a photogene in crystalline form and LUDWIG 2) asserts that in micrococcus Pfluegeri it is not the colonies themselves but the excreted metabolites that glow. All other investigations into photogenes have so far led to negative results and the theory mentioned under 2 must therefore not be regarded as proven.

Illumination of bacteria is generally considered ineffective in affecting their ability to phosphorescent; only DUBOIS 3) mentions a weakening of the development of light in bacteria which have been exposed to light for several days. The fact that the bog glow in the tropics can assume such excessive forms, even when the sky has been cloudless for many days, suggests that at least some of the glowing forms of bacteria are possessed of a comparatively great resistance to sunlight. A study of the effect of concentrated electric light on such forms would be of interest.

1) Comptes rendus de l'académie des sciences, Vol. CVII, p. 502. 2) Centralbl. f. Bacteriology, Vol. II, p. 40. 3) I. c.

sensitization.

The cause of the great difference, with regard to bactericidal activity, between the blue-violet and ultraviolet rays on the one hand and the less refractory rays on the other must be sought partly in the unequally strong absorption of the different qualities of rays - the stronger the absorption, the greater the effect, partly in the fact that the manner in which the energy of the absorbed rays is converted varies with the frequency of vibration of the rays concerned, so that the short-wave rays may cause a chemical process in the protoplasm of the bacteria which is killing, while the long-wave ones convert to heat or some other form of energy takes place, which is derived under the given conditions without harming the bacteria.

As mentioned in the introduction, both the absorption of light and its mode of conversion depend not only on the type of radiation (wavelength), but also on the properties of the body in which it is absorbed. If one changes these properties, then there is also a change in the effect of the light on the body in question. It is therefore clear that if one is able in one way or another to change the properties of the bacterial protoplasm, or perhaps even just those of the surrounding culture medium, without killing the animals thereby, the condition for the possibility is also given here to be able to achieve a different effect of the different spectral rays on the bacteria than the usual one, and this of course applies not only to bacteria but to all living organisms, animal tissue as well as plant tissue.

In 1873 Vogel showed that by adding various substances, the so-called sensitizers, to ordinary photographic silver bromide gelatine plates, they could be made sensitive to types of radiation which previously had only minimal or perhaps no effect on them, and he succeeded in making plates , which were influenced by red and yellow light to almost the same degree as by the more refractable rays (color-sensitive, orthochromatic plates).

The materials that can be used as sensitizers are often, but not always, fluorescent dyes; a whole series is now known with the help of which the sensitivity of photographic plates to different spectral regions can be increased.

While VOGEL's discovery has found extensive application in photographic practice over the past 30 years, a satisfactory theoretical explanation of the phenomena has failed to be found; it is still undecided to what extent it must be ascribed to altered absorption ratios or an altered mode of conversion of the rays in question.

Analogies to photographic sensitization have been thought to be found in a number of biological phenomena. It is well known that various fluorescent pigments, of which chlorophyll (leaf green) is the most widespread, are of crucial importance for the assimilation of carbonic acid in plants. I shall make them the subject of a detailed discussion later; In this context, I just want to remind you that these dyes were regarded as sensitizers, in analogy to Vogel's, as substances that only transfer the energy of the light rays to leafy green bodies without themselves contributing directly to the absorption of carbon and the elimination of oxygen own. ENGELMANN 1) drew such a parallel as early as 1883, and he showed experimentally how the maximum effect in relation to oxygen excretion can be attributed to different spectral rays, all depending on whether the leafy green bodies of the plant in question contain this or that of the pigments mentioned. TIMIRIAZEFF carried out the same idea at the International Botanical Congress in St. Petersburg in 1884, where he asserted that there was a complete analogy between the importance of chlorophyll for the carbonic acid assimilation of plants and the importance of colored sensitizers for the photographic process. According to Bequerel's experiments (1874), chlorophyll also has a sensitizing effect on photographic plates.

So-called visual purple is an animal dye whose various properties (fluorescence, bleaching by light, etc.) call for comparison with photographic sensitizers. This pigment, which is known to be bound to the outer segments of the retina rods, varies not inconsiderably in its color nuance in the various animal species, from red through purple to violet. That the visual purple is a great

It is certain that it is important for the perception of light, but up to now it has not been possible to give a proper analysis and explanation of the process. It

1) Bot. Newspaper 1883. Communications a. Finsens Medical Light Institute. viii

however, there is strong evidence that expanding our knowledge of photographic and biological sensitizers will help elucidate this important phenomenon.

In the pharmacological laboratory in Munich, TAPPEINER!) and his students: RAAB2), DANIELSOHN 3), JACOBSOHN 4) and ULLMANN5) have carried out a series of extraordinarily interesting investigations into the effects of various fluorescent substances in the light and in the dark over the course of the last 5 years . RAAB found that infusoria (Paramaecium caudatum), even in highly dilute acridine solutions, are killed significantly faster when left in the light than when left in the dark, and also faster in direct sunlight than in diffused daylight. The same was the case with experiments with other fluorescent solutions. RAAB summarizes its attempts in the following points:

1. Exposure to daylight has a very deleterious effect in experiments with acridine, phosphine, and eosin.

2. This influence is due to the generation of fluorescence.

3. The effective rays are those which produce the strongest fluorescence.

+. It is probable that fluorescent bodies are capable of converting the energy of light rays into living chemical energy.

1) Munich med. Weekly, Jan. 2, 1900 and Nov. 5, 1901. 2) Journal. f. Biology 1900, Vol. XXXIX.

3) DANIELSOHN, On the Effects of Various Acridine Derivatives on Infusoria. Diss., Munich 1899.

4) journal f. Biology 1901, Vol. XLI.

5) ULLMANN, About the effects of electric arc light on microorganisms in the presence of fluorescent substances. Diss., Munich 1901. 1) Journal. f. Biology 1902, Vol. XLIV. 2) Annales de l'Institut PASTEUR 1902, no. 8. 3) l.c.

5. It is probable that fluorescence also plays a part in the animal organism, but to a far lesser extent.

In a later work RAAB writes). Quinoline red and harmaline solutions show the same fluorescent effect on Paramaecium caudatum as acridine and phosphine. The effect of the non-fluorescent fuchsine and crystal violet solutions, on the other hand, is not increased in the light. He also found that sunlight can produce local necrosis (in the ears) in white mice previously injected with eosin - a phenomenon which he is inclined to interpret as a burn due to strong absorption of heat rays. In general, RAAB does not seem to see a mere light effect in these phenomena, but rather an increased toxic effect of various fluorescent substances caused by the light; he remarks, however, that there is no increase in the toxicity of the liquids if they are first exposed to light and then placed in the dark after the Paramecia have been added. In contradiction to this, LEDOUX-LEBARD 2) found that the active rays change the composition of the eosin and produce a substance in it that is poisonous to the Paramecia.

JACOBSON 3) examined ciliated cells (from the pharynx of frogs) suspended in various fluorescent liquids. There was a significantly faster cessation of the flickering movements in the light than in the dark. A second attempt was made as follows: subcutaneous injection of 2 centigrams of eosin in solution into a frog, which then gave 24 resp. was kept in the dark for 48 hours. Although the frog's tissue turned red, the fibrillation motion was not affected. JACOBSON then prepared preparations of the ciliated cells from the pharynx and placed them partly in the dark and partly in the light. In the specimens that had been left in the light, he confirmed the death of the ciliated cells after 3 hours, while in the ciliated cells that had been left in the dark he still found clear ciliating movements after 24 hours. After subcutaneous injection of eosin at 0.00015 per g animal, the frogs appeared severely incited in direct sunlight: after 6 hours paralysis of the hind legs occurred and the animal was dead the following day after 2 hours local paralysis of the muscles except the heart, which continued to function for about 5 hours. Frogs injected with equal amounts of eosin but kept in the dark showed no phenomena of paralysis and continued to live. The frogs could even tolerate doses of 0.002 per gram animal without significant symptoms of poisoning if they were only kept in the dark.

By emptying the cavum cranii in frogs and introducing cultures of Paramecia into the resulting cavity, and exposing some of the preparations to the light and others to the dark, JACOBSON found that the light, even after passing through a layer of animal tissue, was capable of finding Paramecia kill.

While TAPPENIER") compares the phenomena described here with those known to us from photographic sensitization, JACOBSON ascribes a very decisive importance to the toxic effect of the substances in question; he writes:

1) Munich med. weekly Jan 2, 1900.

1. The light increases the toxic effect of fluorescent substances on ciliated epithelium.

2. Non-fluorescent, toxic substances have no increased effect in the light.

3. Non-toxic fluorescent bodies have the same effect on flicker motion, in the light as in the dark.

In Finsen's laboratory, DREYER) has dealt with this question and has subjected it to careful investigation by means of a series of different experiments. He asserts that the effects of the substances discussed here must be understood as a sensitization analogous to the sensitization of photographic plates, and he comes to the conclusion that "by using certain sensitizers, microorganisms and animal tissues can be substituted for the otherwise ineffective ones but relatively highly penetrating yellow and yellow-green rays as sensitive, even to a greater degree , than are normal to the highly penetrating but less penetrating chemical rays. - As a sensitizer, DREYER used erythrosine (tetraiodofluorescinodium); this dye, which is most frequently used in orthomatic photography, proved to be particularly effective in these experiments. He used solutions of 1:5000 or 1:8000. He tried the effect on infusoria (Nassula) and bacteria (Prodigiosus, etc.), which he exposed to the concentrated light of an electric carbon arc lamp of 20 amperes and 50 volts. The tables below show the enormous bactericidal activity of the otherwise ineffective yellow and green rays against the sensitized microorganisms.

1) Communications from FINSEN's med. Light Institute 1904, Issue VII.

By injecting erythrosine solutions into the dorsal lymph sac of frogs or local, cutaneous injections into rabbits and humans, DREYER also showed that animal tissue can be sensitized so that otherwise ineffective radiation can cause inflammatory phenomena in the same. These inflammatory phenomena do not resemble, macroscopically and microscopically, those which characterize the general "light reaction": but there was a clear analogy; the difference seems to be due more to the fact that the changes in the sensitized tissue were more profound, and that thrombosis of the larger vessels also occurred. If this explanation is correct, it speaks for that view of the phenomena discussed here, which it ascribes to a direct light effect made possible by the presence of the substances in question, i.e. in other words for an analogy with the effect of optical sensitizers on silver halides. - As mentioned, JACOBSON 1) has, among other things

. for the more toxicological view and considers the toxic effect of the fluorescent substances to be the decisive moment, even if the toxicity is possibly so low that it cannot be detected if the effect of light is excluded. JACOBSON'S assumption that "non-toxic fluorescent dyes are ineffective" is, however, based only on experiments with a single substance (esculin), just as he has investigated only acid fuchsin of toxic but non-fluorescent bodies. The experiments call for further investigations; but they prove nothing regarding all other non-toxic or non-fluorescent bodies*).

However, the difference between the two theories discussed here is perhaps more due to a somewhat unclear definition of the term "light reaction" on the one hand and toxicity on the other.

1) I.c.

*) Some experiments, which I carried out after the above was already available in proofreading, gave the result that Koch's plate method cultures of Bac. prodiciosus ca, were sterilized seven times faster in concentrated light that had passed through a filter with a 5% monochromatic potassium solution when the culture medium (agar) was stained with thin fuchsin solutions (1:5000) than when it was unstained. The answer to the question must remain open for the time being, to what extent the killing here is due to the simultaneous occurrence of two harmful potencies (the toxicity of fuchsine and the bactericidal nature of the yellow-green rays), each of which only ge. have little effect on the bacteria or whether it is due to increased absorption of the rays due to increased exposure to light.

As a contribution to understanding the sensitization, DREYER cites the following:

1. Fluorescence is not critical in sensitization; because there are substances which fluoresce strongly and which either only cause weak sensitization or do not sensitize at all (aesculin, fluorescin), and on the other hand there are substances which do not fluoresce and yet can sensitize (cyanine).

2. The absorption is also not decisive; for there are both fluorescent and non-fluorescent substances which absorb strongly and yet are not sensitized to the rays which they absorb.

3. The sensitization is hardly based on the fact that toxic compounds are formed in the sensitizer during exposure, which have a harmful effect on microorganisms and animal tissues; because if a sensitizer such as For example, if erythrosine is first exposed to light for 10 minutes and then used for sensitization immediately after exposure, its sensitizing ability will prove to be very significantly reduced, as can be seen from the attached table.

However, the first two points should only be understood in such a way that neither the fluorescence nor the absorption is the only decisive factor; for both parts are undoubtedly important: the absorption, of course, is; for if the yellow or green rays were not absorbed, they could not have any killing effect, and as for the fluorescence, it can hardly be due to chance that almost all the dyes which are to be found in the above-mentioned Experiments have found to be more or less fluorescent.

A number of non-fluorescent photographic sensitizers are known; but the fact that a dye has a pronounced sensitizing effect on photographic silver halides does not entitle us to assume that it is also a sensitizer to "living" organisms. Even within the field of photographic processes, a and the same dye is sometimes effective as a sensitizer, sometimes ineffective, and in addition a distinction is made here between optical and chemical sensitizers, since one and the same substance often combines both properties; later investigations must decide whether one should not also use the sensitization of living organisms, faces phenomena which, even if they lead to similar results, can nevertheless be of an essentially different nature.

TAPPEINER) has extended his sensitization studies to areas other than those discussed so far; he has shown that both enzymes (papayotin, diastase, invertin) and toxins (ricin) are weakened when they are exposed to certain fluorescent substances, e.g. eosin or magdala red - were exposed to the action of light, while undergoing no demonstrable change when stored in the dark after the addition of such substances.

1) reports dd chem. Society 1903, Vol. XXXVI, p. 3035.

The artificial sensitization discussed here is not only of great theoretical interest, but also has the prospect of attaining extensive practical significance, including in relation to phototherapy. As early as 1900, TAPPEINER concluded his first presentation of the works discussed above with the following claim: "Conversely, perhaps through incorporation or Application of certain fluorescent substances when exposed to light also set therapeutic effects, so that such substances z. B. would find a similar use in dermatology as has been empirically the case in photography for about 10 years with eosin and other fluorescent dyes as "sensitizers". - In the light treatment of lupus

's Light Institute and in Munich to achieve an increased effect by sensitizing diseased tissue; the orienting experiments have not yet been completed, but there are many indications that we are facing an extraordinarily valuable technical advance within light therapy *).

*) After the appearance of the Danish edition of this book, several new works by TAPPEINER and his students have appeared:

TAPPEINER and JESIONEK, Therapeutic experiments with fluorescent substances. Munich med. weekly No. 47, 1903.

TAPPEINER, On the knowledge of light-acting (fluorescent) substances. German med. weekly 1904, no. 16

TAPPEINER, Is the effect of the fluorescent substances based on sensitization: Munich med. weekly 1904, no. 16

WEDDING 1) mentions that cattle and sheep fed buckwheat develop a blistering rash when exposed to sunlight or even diffuse daylight; skin inflammation, on the other hand, does not occur if the animals stand in the dark, and piebald cattle are attacked only on the unpigmented spots.

In his treatise on the influence of light on the course of smallpox, Finsen speaks of this peculiar phenomenon, which is also well known to country people, and writes: "So we see that the skin can be brought into such a sensitive condition that even a slight , absolutely meaningless under normal circumstances, is capable of producing even significant affections." In the above-cited review of the effects of fluorescent toxins in the light and in the dark, TAPPEINER also touches on the buckwheat question, commenting on the appearance of these

TAPPEINER and JODLBAUER, About the effect of fluorescent substances on diphtheria toxin and tetanus toxin. Munch. medical weekly 1904, no. 17

TAPPEINER now seems to understand the phenomena discussed here exclusively as the effects of phosphorescence light, and he proposes replacing the term "sensitization" with "photodynamics". It is hardly necessary to discard a term so well known and apt as sensitization; but of course one has to give it an equally extensive meaning in biology as in photography, where the term sensitization is used as a general term for processes of a very different nature. The word "sensitizer" is only a practical generic term for all substances that have the ability to increase the sensitivity of a body to light in one way or another, regardless of whether this is achieved by more powerful absorption of the rays or by a conversion of the less effective rays to more powerful fluorescent light, or by binding halides or other substances in statu nascendi, or finally by a combination of these or perhaps several other types of effects.

I) negotiation i.e. Berlin Society for Anthropology 1887, p. 57.

Skin inflammation for possible absorption resp. Formation of fluorescent substances from the feed pronounces. I later looked into this question, since I did not consider it impossible that buckwheat could contain a substance capable of sensitizing the skin: it can make it sensitive to rays that otherwise do not cause inflammation. Since almost all biological sensitizers known to date are fluorescent, I thought to myself that it must be a fluorescent dye that is peculiar to buckwheat. The director of the pharmaceutical school in Copenhagen, Prof. KOEFOED, to whom I hereby express my sincere thanks, did me the great kindness of carrying out some analyzes which gave the positive result that both the common and especially the silver buckwheat contain a fluorescent red dye which is cannot be detected in the common types of grass. This dye, which Prof. KOEFOED suggests calling "fluorophyll", is soluble in alcohol and ether, but insoluble in water. (A more detailed description of this substance and its presentation will appear in reports from FINSENS med. Lichtinstitut, booklet IX.)

To carry out systematic investigations into the sensitizing ability of the fluorophyll, too small quantities of the substance have been produced up to now. A few tests, for which I had only about 11 grams of the substance at my disposal and which were also made more difficult by its insolubility in water, yielded negative results. The proof that the buckwheat rash is due to an effect of light on the sensitized skin has not yet been given; but already the circumstance: The. Buckwheat contains an aurorecent substance, which is not found in other feed substances, speaks for the correctness of the hypothesis. Whatever the outcome of continued investigations in this particular area, I think it probable that a process so peculiar and so effective in its effects as sensitization must play a far more important role than previously thought, and that perhaps many apparently very different biological and pathological phenomena will find their natural explanation through these *). I would like to address here only one question which defies experimental investigation but can easily be solved clinically.

Among the substances that have been shown to have sensitizing properties are quinine and various quinine derivatives. It is known that these preparations have a specific curative effect on malaria patients, an effect which is difficult to explain solely from the toxicity of quinine to malaria plasmodia, although according to the available experiments this is probably very important. Is it probable that the sensitizing properties of quinine preparations are completely irrelevant to their therapeutic effect? The lack of understanding of the "specific" effect of the quinine salts means that not a single one of their peculiarities should be ignored, and least of all such a pronounced ability as their sensitizing ability, if an explanation is to be sought. An investigation as to whether daylight contributes at least something to the favorable results of quinine treatment by killing or weakening the possibly sensitized malarial plasmodia. carries, would therefore well be justified.

*) FINSEN supposes that the peculiar sensibility which the skin of small-pox patients has to light, a sensibility which, as mentioned, he has from the first placed in class with that known from buckwheat disease, may find its explanation in a similar way .

I shall very briefly state a few reasons on which I believe I can base this view.

1. Quinine fluoresces even in extreme dilutions (1:1,000,000), and its sensitizing ability is evident from ULLMANN's investigations, among others, which show that Paramecia attached to quinine solutions of 1:20,000 only appear after about 5 hours of standing in the dark die, being killed within 8 minutes if placed in sunlight under conditions otherwise not detrimental to Paramecia.

2. According to JACOBSON's and DREYER's 3) experiments, light, even after passing through a layer of animal tissue, can exert its microbicidal action on the sensitized organisms. The depth at which they are still able to exert such an effect will of course depend, among other things, on the intensity of the light.

3. The tissue elements of the human body are pellucid and even if only a relatively small part of the body surface is exposed to light, the blood and thus also the plasmodia, due to the constant circulation, can be influenced by the light.

Should the hypothesis presented here prove to be correct, which can easily be decided by clinical examinations of quinine-treated patients in the light and in the dark, then it seems indicated that malaria patients should be treated

I)). c. 2) 1st c. 3) I.c.

to be treated after quinine with sun baths or electric light baths*).

A completely opposite treatment, a treatment of malaria patients in the dark, was proposed in 1902 by the well-known American doctor AFA KING'), who was the first to propose and scientifically substantiate the theory of the transmission of malaria infection by mosquitoes in 1883. KING believes that he can explain a number of the clinical and epidemiological properties of this disease on the assumption that the sporulation of malarial plasmodia cannot take place in the dark but only in the light, especially red light, and he therefore recommends treating the patients in the dark or in rooms with purple or violet windows, i.e. negative phototherapy in analogy to Finsen's treatment of smallpox. As it is beyond the scope of this book, I do not wish to enter into a detailed discussion of King's interesting and ingenious reasoning; I just want to emphasize his adherence to his negative phototherapy, although he suggests that the healing effects of quinine sulfate may be related to its fluorescent properties.

In the foregoing, only sensitization to the various spectral rays is spoken of. From a theoretical consideration similar to that which I asserted at the beginning of this section, however, there also seems to be a possibility that by means of fluorescing substances the sensitivity to other forms of radiant energy (X-rays, Becquere rays, etc.) can be increased in organisms which, under ordinary circumstances, are only slightly affected by these rays. -- In this direction I have in community with Dr. Sum made a number of uncompleted attempts. However, these have not led to any positive results so far *).

*) See in more detail: GUNNI BUSCK, Om Dagslysets Indflydelse paa Forlöbet af Malaria, med særlig Henblik paa Kininbehandlingen. "Hospital Nursing" No. 16, 1904, and: The Influence of Daylight in the

Progress of Malaria more especially in connection with quinine Treatment. The American Journal of Medical Sciences, July 1904.

1) The American Journal of the Medical Sciences, February 1902.

The Effect of Light on Vaccines, on Bacterial Toxins,

on enzymes & $. W

FINSEN and DREYER") have shown through experiments that light, and especially its ultra-violet rays, can weaken or destroy smallpox vaccine. Smallpox vaccine was applied in drops to rock crystal plates and treated with the concentrated light of an electric arc lamp of 25 amps, 50 volts; the thermal effect was prevented by sprinkling cold water over it and the result of exposure was examined by subsequent inoculation of the vaccine on children. Exposure lasting more than 10 seconds resulted in a marked weakening of the vaccine, while exposures lasting about 200 seconds usually resulted in total nullification of the vaccine's ability to induce pustules.

*) After the appearance of the Danish edition my attention is drawn. 167, according to which an American doctor, Dr. MORTON, treated a number of "cancer cases with X-rays after giving large doses of quinine to the patients concerned.

1) Notifications from FINSENS med. Light Institute 1903, Issue III.

As a comparison, the killing of a prodigiosus culture under reasonably appropriate lighting conditions within 40 seconds is given. Exposure to blue or clear glass, which blocks the ultra-violet rays, did not result in destruction of the vaccine for 15-20 minutes.

The light also has a strongly destructive effect on the toxins of the bacteria and on all the enzymes which have hitherto been the subject of investigation in this regard.

TIZZONI and CATTANI) found that long-term exposure to sunlight is not only able to kill tetanus bacilli, but is also able to render tetanus toxins ineffective; this destruction proceeded most rapidly with the access of the oxygen in the air. These experiments are confirmed by FERMIS and CELLIS? Studies showing that tetanus toxin completely loses its toxicity after exposure to sunlight for several days. Later investigations revealed similar behavior of other bacterial toxins.

Concerning the enzymes, DownEs and Blunt, who extended their extensive and excellent investigations to this field, found destruction of the invertin (macerated compressed yeast) in sunlight, so that it loses its ability to transform cane sugar.

GREEN ") has extraordinarily pretty experiments

1) Archive for exper. Pathology 1890, XXVII.

2) Ref. in: Centralbl. f. Bacteriology 1892, XII, no. 18

3) Proceedings of the Royal Society of London, Vol. XXVIII, p. 205.

4) Philosophical Transactions of the Royal Society of London 1897, Vol. CLXXXVIII, pp. 167-190. Notices a. Finsen's medical light institute. viii

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demonstrated the destructive effect of light on the diastatic enzyme present in the leaves of plants; the action derives from the ultra-violet rays, while the blue and especially the red rays have a beneficial effect, inasmuch as they can convert the zymogen of the diastase to the active form.

SCHMIDT-NIELSEN !) recently carried out a series of investigations into the effect of light on chymosin ("Lab") in the local laboratory. He exposed it to light in small chambers with quartz walls and used the time it took 0.1 cm 3 of enzyme solution to coagulate 10 cm 3 of milk at a temperature of 37° as a measure of the effect of the light. Unconcentrated electric light and sunlight had little effect on chymosin, while even quite brief exposure to concentrated electric light prolonged the coagulation time significantly. The action was due to the ultra-violet rays, and the interposition of a piece of clear glass sufficed even to prevent the destruction. If the chymosin was kept in the dark after exposure, a clear after-effect could be seen after one day.

An attempt to make the enzymes sensitive to visible rays by adding a sensitizer (erythrosine) gave negative results; however, as mentioned earlier, TAPPEINER) has shown that both enzymes and toxins can be sensitized using eosin or Magdala red.

On the chymosinogen - the zymogen or proenzyme of chymosin

ultra -violet rays practiced a similar

I) Communications from FINSEN's Medical Light Institute 1904, Issue IX.

2) reports dd chem. Society 1903, Vol. XXXVI, p. 3035.

deleting effect as on the rennet, and in contrast to GREENS experiments mentioned earlier, SCHMIDTNIELSEN found that the red rays had no activating influence.

Ordinary blood serum has the property of being able to prevent the action of the enzymes; the substance we are dealing with here is antichymosin

was also weakened in the light.

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NIELS R. FINSEN

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KØBENHAVN

GYLDENDALSKE BOGHANDEL

NORDISK FORLAG

1904

(JUNE)

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HE LYSETS BACTERICIDE VIRKNING EN

ILTNINGSPROCES?*)

AF

VALDEMAR BIE

LITERATURE OVERVIEW

Paa Forhaand skulde man tro, at that var not at afgøre dette Spørgsmaal; When you get the work done, you have the upper hand for Forsøg paa at the solution, you can move and go at faa and other Opfattelse. Gang efter Gang ere Forsøgene udførte paa omtrent samme Maade, nemlig ved at belyse in Række Kulturer under saadanne Forhold, at the atmospheric risk air havde Adgang til dem, og en anden Række i Vacuum eller under en indifferent air type. Because forsøgsordning he utvivlsomt completely correctly, men underestimated

And to the Trods for, at the forskellige Forskere have udført deres Forsøg paa omtrent samme Maade ere Resulterne reaches fra at stemme overens.

To af de paagældende Forskere [LEDOUX-LEBARD og BUCHNER] have fundet, at Ilten aldeles ingen Betydning har for Lysets Evne til at dræbe Bacterier; others [DOWNES og Blunt, DUCLAUX, Roux, GAILLARD, Tizzoni og Cattani, Kruse, DIEUDONNÉ), have den helt modsatte Mening: at denne Evne he betinget af Tilstedeværelsen af Ilt; Eventually, a third group of Forsøg (MoMONT'S and KEDZIOR's) gives and result, so that it is easier to disse to Yderpunkter, namely at the most powerful bactericide Virkning opnaas ved Samvirken mellem Lys and Ilt, men at Lyset dog ogsaa kan dræbe Bacterier i Vacuum eller i en indifferent air type.

I the following giver each and oversigt over the tidligere Under

*) Afhandlingen har været trykt tidligere som Del af min Doktoraf handling.

søgelser for Overskuelighedens Skyld inddeler jeg den i de tre nævnte Grupper, arrange efter Results af Undersøgelserne. For giving en Forestilling om, med hvilke Forudsætninger hver entkelt Forsker founded sine Forsøg, har jeg requested, i hvilket Aar disse udførtes.

To all de her nævnte Forsøg he brugt Sollys. En Redegørelse for de Fejlkilder, to hvilke these Forskere ikke have tagt tillstrækkeligt Hensyn, see p. 12 and flg.

1. The following Forsøg have given the result, at Ilten he uden Betydning for Lysets bactericide Virkning.

LEDOUX-LEBARD (1893) describes in days old bouillon cultures on Difteribaciller, on test tubes, on glass tubes, on other things that are different in one end, and others that are melted in one end. 29/5 Kl. 12 Midday hanged han Glassene op i spredt Dagslys, indenfor et Vindue. the vendte mod north. Efter 29 Timers Forlob saaede han over paa Serum. The viste sig ingen Forskel paa de forskellige Kulturer. Altsaa, slutter Ledoux-Lebard, he Ilten uden Betydning for Lysets bactericide Virkning.

BUCHNER'S (1893) Fremgangsmaade var following: 100 cm. Brøndvand med Tilsætning af noget Kødekstrakt fyldtes i snæverhalsede Kolber, i hvilke dette Kvantum Vædske naaede op til Halsen, dels i vide Erlenmeyers Kolber, i hvilke Vædsken thenede et kun 1 cm. højt Lag. Efter Kogning i Dampcylinder ved 1000 i 2 timers lukkedes de snæverhalsede Kolber med Gummiprop, Erlenmeyers Kolber med Vatprop. Next Dag saaedes B. coli deri ; ved denne Lejlighed fyldtes de snæverhalsede Kolber's neck med air; i these Kolber var altsaa kun en lille Vædskeoverflade i Berøring med en ringe Mængde Luft, som ikke customer fornyes; i Erlenmeyers Kolber var derimod en stor Vædskeoverflade i Berøring med en rigelig Mængde Luft.

Kolberne belystes i 1'/, Time i diffused Dagslys og 1 Time i direct Sollys. Vandet temperature var 16-20° C. Control flask stode i Morke. For Belysningen og efter dens Afslutning foretoges Tælling med the following result:

Buchner writes, at selv om der ikke kan være Tale om en virkelig Udelukkelse af Ilten ved because l'orøgsordning, he den tilstrækkelig til Afgørelse af the praktiske Spørgsmaal, om det større eller ringere Indhold af Ilt har nogen Betydning for Lysets Virkning. Efter ovenstaaende Forsøg maa dette Spørgsmaal besvares benægtende."

II. The following Forsøg have given the result, at Ilten vel favorable Lysets bactericide Virkning, men ikke he en Betingelse for the.

MOMONT's Forsøg (from 1892) heard kun delvis til denne Gruppe; Remainders are described under III. Group. Before listening to Forsøg used Momont indtørret Blod af Dyr, the vare døde af Miltbrand, including indtørret sporefri Bouillonkultur af B. anthracis. Tørringen foregik paa the following Maade: Momont lod Draaber af vedkommende Vædske flyde ud over Væggen af test tube; this is recommended in a vacuum desiccator with Svovlsyre; Draaberne fordampede i Løbet af nogle Øjeblikke, men Reagensglassene bleve dog først tagne ud efter 12 Timers Forløb. En Del af Reagensglasene lukkedes med Vatprop, saa at Luften havde Adgang til deres Indre. Remaining pump of the air tomme med van air pump; Derefter Lod Momont Brint slips in the, pumped atter then and, and Skiftede halledes mellem Vacuum and Brintfyldning indtil 7-8 Gange. Efterat Brinten for sidste Gang var pumps ud, tilsmeltedes Reagensglasene. This airtight test tube and full airflow with the airflow for direct Sollys, frit ophængte 1 meter above Jorden. Temperatures var 25° - 35°. Forsøgene udførtes i May, June and July in Paris.

Indtørret mittbrandheldigt Rabbit blood sterilized with 8 timers Belysning in atmospheric air, 11 timers Belysning in Vacuum; for sporefri Bouillonkulturs Vedkommende vare de tilsvarende Belysningstider 5 — 51/2 og 61/4 Time.

KEDZIOR (1899) worked with Vibrio Metchnikovi som GelatineOverfladekultur i en Petris Skaal, the var anbragt i et Botkins Apparatus, fyldt med Brint. En Del af Kulturen var dækket med sort paper after Buchner's Mønster. After 3 timers Belysning var Antallet af levedygtige bacteria in the belyste Del af cultures gaaet ned til det halve. Ved et andet Forsøg paavistes, at the bactericide Virkning dog he betydeligt ringere, naar cultures staar i en Brintatmosfære, end naar the staar i atmosfærisk air.

III. In the following Forsøg third bacteria kun ved velvety Paavirkning af Lys and atmospheric air.

DOWNES and BLUNT (1878) pumpede fire test tube with frisk, sur Urin saa vidt Lufttomme, at vædsken kogte og Luftpumpens Kvægsølv i et eller to Minuter var faldet med en vel markeret Lyd som af

together

in Vandhammer; derefter tilsmeltedes Glassene og stilledes ud i Sollyset; de to udsattes for dette, men de to andre vare lystæt indpakkede. Fire tilsvarende Glas, the vare lukkede med Vatprop, stilledes paa Maade i Sollyset. Efter fire Days Forløb var Urinen plumret i de to lystæt indpakkede Glas, der vare lukkede med Vatprop, næste Dag blev Urinen i alle de fire lufttomme Glas plumret, endda most i de belyste Glas; endnu to Day senere var the urine clear, som var belyst under Vatprop

Downes og Blunt udtrykke their Opfattelse in the following Sætning: "Vi slutte derfor,

At the iagttagne Virkning paa these Organismer ikke afhænger af Lyset i sig selv, men at Tilstedeværelsen af fri Ilt he nødvendig, idet Lys og Ilt tilsammen udføre, hvad ingen af dem kan gøre alene."

DUCLAUX (1885) iagttog, at tilsmeltede helt fyldte Glasblærer med Kulturer af forskellige Tyrothrixarter (T. scaber, filiformis og geniculatus) customer udsættes for Sollyset i tre Maaneder uden at tage Skade, medens Sporer, der vare indtørrede paa Bunden af en vatlukket Also the old days are in Berøring with a clear Mængde Ilt, third from 1-2 Maaneders Belysning. Duclaux slutter heraf, at ,,Sollysets specielle Virkning utvivl. somt more favorable den kemiske Iltningsvirkning." ("Ceci temoigne de l'action spéciale de la lumière du soleil, qui intervient sans doute pour activer l'action chimique d'oxidation.")

I en senere Oversigtsartikel (Annales de l'Institut Pasteur 1887, p. 88) comes han til den Slutning, at Lysets hygiejniske Virkninger knyttet til Tilstedeværelsen af Ilt."

Roux (1887) used to sine Forsøg Miltbrandkulturer i Humor aqueus af Okseøje; for Belysningen opvarmede han dem til 700 i 10 Minutes for at tilintetgøre de udvoksede bacteria. En Draabe af Kulturen fortes over i tomme test tube, som tillsmeltedes; de containt approx. 20 cm. 3 air. Ultimately, the glass tube will be formed with cultures and will be melted in the end; Sporerne heri havde altsaa kun Adgang til den Ilt, der var absorberet i broths. All these glass bleve udsatte for Julisolen, frit ophængte for at undgaa for stærk Opvarmning. After Belysningen blev der fyldt Bouillon in Reagensglasene, og

Vædsken fra de tenformede Glasrør Tømtes ad i Bouillon, above all Bouillonglasene stilledes in the thermostat.

Sporer, who ware belyste i de helt fyldte, tilsmeltede, tenformede Rør i 83 Timers gave en smuk Kultur, medens de, the bleve udsatte for Luftens og Lysets Paavirkning velvety, dræbtes ved mindre end 30 Timers Belysning.

GAILLARD (1888) used the same terms as Fremgangsmaade as Ledoux-Lebard, Duclaux, Roux and delvis Momont. Bouillon, hvori der var saaet Miltbrandbaciller, Tyfusbaciller eller Staf. pyog. aur., fordeltes

In Pasteur's Pipetter, the blue pump de air drum with Kvægsølvluftpumpe and tilsmeltede. Derefter belystes de; om Natten bleve de requested i Isskab. After Belysningen, Gaillard has air slips in the Rørene and still in the thermostat.

Bacterierne in the Lufttomme Rør dræbtes ikke selv ved 50-60 Timers Belysning, medens ved et enkelt Forsøg med Tyfusbaciller Kulturen i Rør, der vare luckede med Vatprop, steriliseredes ved at udsættes for Lyset in nogle faa Timer.

Gaillard slutter heraf, at Lyset can follow kun virke paa Bac. anthracis, on cultures he i Berøring med Luften eller selv indeholder atmosfærisk Luft" og "Lysets Virkning paa Bac. tyfos. he afhængig af én Betingelse, nemlig Tilstedeværelsen af atmosfærisk air."

Tizzoni and CATTANI (1890) indicated the subcutant pairs and rabbits 1/2 cm. 3 af about 1/2 Aar gammel gelatine tetanus culture, the vokset under Brint og havde staaet i 5 Maaneder foran et Vindue, som sold mod Nordost. Dyret dode af Tetanus efter 7 Days Forløb. Cultures are at the end of Vinduet, because there is a passage in Berøring with atmosfærisk air. Efter lidt over en Maaneds Forløb injected atter / cm. subcutant paa en rabbit; Because the course has Indsprøjtningen ingen Følger. Ved Anlæggelse af ny Gelatinekultur under Brint paavistes, at Kulturen var steriliseret ved Belysningen.

KRUSE (1895) said Tyfusbaciller in a test tube with broth; en Del af disse fyldte han med Brint, en Del lukkede han med Vatprop. Efterat de havde været udsatte for Sollyset in forskellig long Tid, lavede han Spredningskulturer til Tælling af Bacterierne. This results in the following scenario:

3

in

var

3

Pair of connecting Maade for løb et Forsøg med Vacuum in Stedet for Brint.

Kruse writes the following: "Iltens Deltagelse i Insolationsvirkningen er oldsaa sikkert paavist. I det højeste kunden det være Gestand for Tvivl, om Virkningen ikke ogsaa kunden opnaas selv ved absolutely lack af fri Ilt, hvis Belysningen var meget langvarig og intense.

To the Række Forsøg af MOMONT, which he contains p. 9, listen,

3

Foruden de the specified Forsøg med tørrede Bacterier, ogsaa the following Forsøg, which are further related to anden Maade, og that gav et helt and the result.

En Draabe sporefri broth culture af Miltbrandbacilli belystes i et luftfyldt, tilsmeltet test tube; Bacterierne bleve dræbte ved 24/2 Times Belysning. Derimod steriliseredes cultures ikke ved 50 Timers Belysning in snævre, tilsmeltede Glasrør, the vare helt fyldte med ca. ", cm. culture.

Paa samme Maade belystes Sporer, opslemmede i distilled Vand. De gik to Grunde ved 44 Timers Belysning in the air flow test tube, but there are 110 Timers Belysning in the helt flow, tillsmeltede Glasrør.

DIEUDONNÉ (1894) comes i sit work om Brintoveriltets Betydning for Lysets bactericidal Virkning ogsaa ind paa at undersøge, om Bacterernes Modstandskraft mod denne er forskellig, eftersom de belyses dels i Vacuum eller Brint, dels i atmospheric air. Han paaviste, at Bact. coli dræbtes ved 11/4 Times Belysning in atmospheric air, men ikke ved 4 Timers Belysning uden Adgang for Ilt. De tilsvarende Tal for Miltbrandsporernes The following were 3/2 and 7 timers. Tetanus spores do not take 9 timers to intensify Sollys and Iltens Medvirkning.

To this speaker he is the reason for at knytte enkelte Bemærkninger.

The customer records, at Uoverensstemmelsen mellem Results from Forsøgene havde sin Aarsag i, at these ikke ere udførte med samme Arter af Bacterier. F. Eks. ere Gaillard and Ledoux-Lebard naaede til ganske modsatte Results, said the ingen other Forskel var paa Fremgangsmaaden ved deres Forsøg, end at LedouxLebard used Difteribacillin, Gaillard derimod Tyfusbacillin, Staf. Þyog. aur. og mildbrand bacilli. The forecomer is very similar to that of the sandsynligt, at a type of bacteria it is assumed that there are other things in the Henseende end in anden. The he deuden saa meget little reason til at antage dette, som he meget andet, hvorved Uoverensstemmelserne find en reached more natural Forklaring

In betingelse for at opnaa et paalideligt result ved these forseg he, at Ilten helt some fra the one Række Kulturer. Særlig Betydning har dette i de Forsøgsrækker, der – saaledes som Ledoux-Lebard's og Buchner's resulter i, at Ilten ingen Betydning har for Lysets bactericide Virkning. This can be anses for bevist, to bacteria dræbes lige hastigt, hvad enten de have rigelig Adgang till it eller de ere fuldstænigt udelukkede fra denne.

Buchner's format has no crævet en saa nøjagtig Undersøgelse; han drager derfor kun Slutninger i store Træk. LedouxLebard derimod udtaler meget bestmt, at det ingen Forskel ger, om he Ilt til Stede eller ej. If it is already stored, the broths contain the substance that is absorbed in the glass tube that melts, and that cannot amount to something that is harmful to itself, since the substance can react to three bacteria.

Ganske tilsvarende Forhold finds i Duclaux's og Roux's Forsøg including de to sidstnævnte af Momont's. I amount of these Forsøgs results have det dog mindre Betydning, om Bouillonen var ganske iltfri eller ej.

He mærkværedt often syndet imod en af Hovedreglerne for al eksperimentel Virksomhed: at naar Resulterne af to Forsøg skulle sammenlignes, maa these orders og udføres paa ganske samme Maade. The most troublesome Afvigelser from that rule finds, that he venteligt, i the ældste Forsøgsrækker, who stems from Tid, because the bacteriological technology endnu var lidet udviklet, og daen Mængde særligt herhen hearing grandchildren, som man senere har lært at day Hensyn til , finally were unknown. Eksempelvis kan nævnes, at til de Forsøg, ved hvilke Bacterierne vare i Berøring med atmosfærisk Luft, brugte Duclaux tørre Bacterier, medens han til de tilsvarende Forsøg med Bacterier, der holdtes ude

, taken from atmosfærisk air, applied cultures in flying Næringssubstrat. Den Forskel i Modstandskraft, som han har fundet, kunde godt skyldes Vædskens Absorption af Lys.

Heller ikke Roux, Ledoux-Lebard og Momont have days Hensyn til, at Lysets Absorption he i høj degrees af hængig af Vædskelagets Tykkelse, og at Brydningen afhænger af Glassets Form. Særlig gælder dette om Momont's Forsøg. To af dem udførtes med indtørrede, sporefri bacteria; whose result var, at Tilstedeværelsen af Ilt kun har en meget ringe Indflydelse paa Lysets bactericide Evne. Til et tredje Forsøg benyttedes ligeledes sporefri Miltbrandbaciller, then because the course belystes Bouillonkulturen uden at indtørre den. Now there was a bacterium gik to the bottom with velvety display on Lys and air in 21/2 time, but there were no 50 timers display on Lyset alene. After all, the results for the Forsøgsrækker for clearer Momont ved, at Bacterierne i det a Tilfælde vare tørre, i det andet derimod belystes i en Vædske. If sandsynligere he det dog, at Forskellen he frenkommen ved, at Forsøgene med tørre bacteria were correctly ordered with the same Vilkaar for bacteria and the air filter glass so that the i det air chamber. In the Forsøgsrække, useful for the used broth culture, som ikke var indtørret, found derimod kun in Draabe culture in the air flow test tube, with the air volume held about 1/2 cm.” Culture.

That he let at se, at halledes som these Forsøg ware order,

de nødvendigvis give et helt andet result end de forstnævnte, correct Forsøg med tørre Bacteria. For the first ware Brydningsforholdene helt forskellige i de to Glas; som jeg senere (p. 20) nærmere forklarer he det uheldigt at belyse en flydende Kultur med buet Overflade. For those andet var absorptions on the chemical Straaler, at least one reaches the Draaben and it helt fyldte glass.

Before the Betydning absorption forheldene have, har jeg paavist ved mine tidligere opentliggjorte Forsøg angaaende the bactericide Virkning af Spektrets forskellige Afdelinger. There is a Lyset - and Lys, with a qualitative Sammensætning var omtrent as Sollysets, aftersom det var elektrisk Lys, der Var gaaet igennem more Glaslinser gaa igennem et 3 cm. Tykt Lag af en 14%2% Opløsning af tvekromsurt Kali, blev den baktericide Virkning nedsat fra Værdien 77 til 5. Since endogsaa lys Kalvekødbouillon har omtrent lige saa kraftig en Farve, som en saadan Opløsning, kan man beht det som sikkert, at is Momont's Forsøg has Forskellen mellem absorptions in Draaben and in the helt fyldte, luckede Glas ligeledes været meget betydelig; He has brugt Oksekødbouillon, has the end there rimeligvis været større end ved mine Forsøg.

This Indvendinger imod Momont's Forsøg gælde ogsaa for Ledoux-Lebard's og Roux's.

En stor Del af Forsøgene leder Tanken hen paa, om ikke Uoverensstemmelsen mellem de forskellige Forskeres Resulter skyldes Brugen af for svagt Lys. Sollyset he i og for sig kraftigt nok til at bruges som Lyskilde; Moment's to Forsøg med tørre Bacterierere Bevis herfor, idet these dræbtes ved at udsættes for Sollyset in 5-11 timers. Kun naar det he got modstandsdygtige Sporer, der Belyses, eller Lyset svækkes ved at gaa igennem et stærkt absorbing Lag Vædske, come der et Misforhold mellem Lyskildens Styrke og Kulturens Modstandskraft; i saa Fald maa Forsøgene strække sig over more Dage, som Downes og Blunt's, Roux's og Gaillard's, yes endogsaa over Maaneder, like Duclaux's og Tizzoni og Cattani's. Naar Forsøget ordains halledes, at Lyset kun ved long Tids Paavirkning can dræbe Bacteria in a culture, which he i Berøring med Ilt, can selv a ringe Formindskelse af Lysets Virkning ved Udelukkelse af Ilten bevirke, at Bacterierne slet ikke dræbes. If you work with svagt Lys, you should therefore let it. This can come at that time, so that the Udelukkelsen af Ilten has disturbing working conditions and which I have in Virkeligheden. Lyset var i forvejen under Omstændigheder, the vare favorable for dets Virkning næsten uvirksomt, Udelukkelsen af llten har til Følge, at det bliver ganske uvirksomt.

Hertil come, at Forsøget strækker sig over mere end en Day, riskier man, at Bacterierne om Natten genvinde en Del af den Vitalitet, de have mistet ved Belysning om Dagen. This can be done for hindsight at Kulturerne stilles in Isskab, selv om man derved undgaar, at Bacterierne formere sig. Som Følge heraf gaar det ikke an at addere Belysningstiderne fr flere Dage og rain dem som en samlet Belysningstid. Hvis Iltmanglen for sinker Bacteriernes Tilgrundegaaen, vil then Afbrydelse af Belysningen i særlig høj Degree bidrage til at forege Forskellen mellem de iltfri og de iltholdige Kulturers Modstandskraft. The longer Forsøget varer, the more gange maa det af brydes, the større Lejlighed faa Bacterierne altsaa til at genevinde deres Vitality, og jo m Ire Bacterierne paavirkes ved den Kelte Dags Belysning, the more sandy synlighed he der for, at de kunne genevinde deres Vitality i praise af Natten.

Langvarigheden maa oldsaa bets som en af de væsentligste Mangler ved in stor Del af de hidtil udførte Forsøg.

Egne Forsøg.

Cases for all my Forsøg have the Fremgangsmaade været, som have anvendt to at Bortskaffe Ilten.

The customer være Tale om enten at bruge Vacuum eller at reimburse the atmosfæriske air med en indifferent air type. Jeg har foretrukket dette sidste, dels fordi det vistnok paa denne Maade lettest lader sig gøre at fjærne ethvert Spor af Ilt, dels fordi Vacuum vanskeligt kunden anvendes i de Forsøg, hvortil jeg ikke har brugt test tube (Række III-VI). Each has found the hensigtsmæsigt

) at anvende Brint, fordi he let at fremstille og at rense, og fordi man he sikret imod, at the dekomponeres af Lyset. Dette, at the customer ske kemiske Omsætninger i de Stoffer, man udsætter for Lys, maa man altid tage i Mengetning, naar man arbejder med saa intense kemiske Straaler, som jeg har brugt.

Brinten udvikledes i et Kipps Brintudviklingsapparat, the rummer ")liter. Since the skulde gaa igennem Vatpropper, maatte the udvikles under Tryk; each forsynede derfor Apparatet med Gummiprop og Stigerør. To Luftudviklingen he uses chemical zinc and Svovlsyre Use the following devices:

1) En's Liters Drechsels Vadskeflaske med alkalisk Pyrogallolopløsning; Hensigten med denne var at absorbere dels llt, dels Syre.

2) Et Rør af Porcellæn or tungtsmelteligt Glas, som var fyldt med reduceret Kobber; The last ones glorified in a Teclus lamp with flat Blus stilled under Røret. For at least, at Lufttræk fik flames til at vifte, saa at Glødningen i en Tid kunde blive at least fuldstændig, stillede every papcylinder udenom Røret og lamps.

3) En 1/4 liter Drechsels Vadskeflaske med distilled Vand. Ved at boble own dette afkøledes Brinten og mættedes med Vanddamp, saa at den ikke customer skade Bacterierne ved for strong Indtørring

4) Et Winkler's absorption apparatus (en Spiral af Glasrør), som laa i rindende koldt Vand, og hvori der var lidt Vand. ved at

8th

Brinten gik own that is written every little more, at the afkoledes og mættedes med Vanddamp.

He paa then Maade fremstillede Brint iltfri? Each often loads the bottle's own alkaline and druesukkerhold Opløsning af indigosvovlsurt soda; because affarves næsten øjeblikkeligt. Denne Prove er imidlertid saa upaalidelig, at den kun betyder meget lidt, naar det gælder om at faa ethvert Spor af Ilt fjærnet. Since the ikke eksisterer noget paalideligt reagents for Ilt, he det umuligt at bevise, at Brinten har været iltfri. Man maa nøjes med, which he urmeligt at days, which ikke har været Tilfældet. Naar Brinten gaar in nogen Tid igennem Apparatet in strong Strom, vil the next efterhanden Rive al the atmosfæriske air with sig. Jeg har therefore altid sat Brintudviklingen in Gang nogen Tid som usually at least 1/2 time for Forsøget skulde begynde. Ogsaa i Opholdene imellem de enkelte Forsøg har jeg ladet the vedblive. Skulde Brinten alligevel helde Spor af Ilt, binds then af the glødende Kobber. Because the method for free stilling on the Brint he expects to see the most paalidelige af Lysinstitutets Kemiker, Hr. like. scientist Biilmann.

Ved at stromme hen over the glødende Kobber opwarmmes Brinten selvfølgelig strengthens. He imidlertid let at afkøle, eftersom dens Varmefylde kun bliver 0,0003, naar Vandets sættes til 1. For at overbevise mig om, at Brinten afkøles tilstrækkeligt ved de Foranstaltninger, jeg har truffet, har jeg udført the following Forsøg:

3

Forsøg No. 1. 14/6 1900.

The Brint, the strommede ad af Apparatet, with Gasblusset under Røret med Kobber var tændt, boblede igennem 5 cm.Vand i et test tube. Ved Forsøgets Begyndelse var Vandets Temperature lig med Stuens, actually 27°; ved 1/2 Times Gennemledning af Brint steg den til 29.5°.

Forsøg No. 2.

Fremgangsmaaden var den samme ved Forsøg No. 1.

Vandet and Stuen's temperature from Forsøgets Begyndelse 19112°

After 20 minutes Gennemledning af Brint, which is not led over glowing Kobber, var Vandet's temperature rises to 21°.

Under the next 20 minutes Gennemledning var Gasblusset under Røret med Kobber tændt; Vandet's temperature rises to 23%.o. Ved Forsøgets Slutning havde Luften i Stuen and Temperature of 2011,.

Result: Den Brint, som forlod Apparatet, var afkølet til Stuetemperatur.

Lige saa vigigt som, at Brinten he ren i det Øjeblik, den forlade Udviklingsapparatet, lige saa vigigt he det, at den let kan continue the atmosfæriske air. Jeg har søgt at skabe favorable Vilkaar herfor, dels ved at lade Brinten boble igennem distilled Vand, hvori Bacterierne vare opslemmede, dels ved at lade den stromme hen over et tyndt Lag Agar, paa hvis Overflade Bacteria vare demanded, dels ved at lade den gaa Own in Celle, the variety is light with and Dækglas, but there are many bacteria that are indtørrede, and the Næringssubstrat. Særlig ved the førstnævnte og the sidstnævnte Fremgangsmaade he the bedst muige Betingelser for at uddrive Ilten. Therefore he det ved these udelukket, at which kan frigøres Ilt ved spaltning af chemical substances under Lysets Indflydelse, fra the mulige destruction af døde bacteria, som jeg ikke customer for hindre.

The other ordering of Forsøgene has been described together with the lower part of Forsøg.

Jeg has started with undersøge optional anaerobic bacteria (Stafylococcus pyogenes aureus). It is possible to state that the minimum requirement for further training is to comply with the mandatory aerobic and anaerobic arteriomas, but it is not possible to gennemføre dette paa Grundaf de vanskelige forhold, hvad Levering af Elektricitet angaar, before he works paa Lysinstitutets Laboratorium siden1, da190ets Laboratorium siden1, da190ets Laboratorium siden1 jeg var færdig med de her beskrevne Forsøg.

Jeg har udført 6 Rækker Forsøg, hvis Ordning i Hovedsagen ses af the following Fortegnelse. Hvert enkelt Forsøg bestod i Belysning af Bacterierne (Staf. pyog. aur.) dels i Brint, dels i atmospheric air. I. Række. Bacterierne vare opslemmede i distilled Vand i et test tube.

II. Række Bacterierne laa paa Overfladen af et tyndt Lag Agar

i et test tube. Lyset gik gennem baade dette og

agars. III.

Bacterierne ware indtørrede direct paa Bjærgkrystal

pleader. IV

Bacterierne vare opslemmede in distilled Vand. Lyset

gik kunnem dette and Bjærgkrystal. V

Bacteria laa paa Overfladen af Agar. Lyset gik

known as Bjærgkrystal and distilled Vand. VI.

Bacteria were indtørrede paa in Glasplade, so that Lyset gik igennem.

I. Række.

Belysning of bacteria, which was treated in the distilled

Vand i et test tube.

Since there are records of Forsøgene, the forest and the most frequent area at faa afgjort, the Lyset overhovedet can dræbe bacteria and Iltens Medvirkning. Anything that is safe at can paavise dette ved at opslemme Bacterierne i distilled Vand og belyse dette, medens enten Brint eller atmosfærisk Luft boblede igennem det. If Fremgangsmaade opnaas, at the bliver muligt fulfilled at uddrive the atmospheric risk air at Vædsken under Brintforsøget, og that he udelukket, at the kan foregaa chemical processors in Vædsken, bortset fra the mulige decomposition af døde Bacterier.

For at være sikker paa, at Bacterierne ikke toge Skade ved Gennemledningen af Brint, har jeg ved Hjælp af et T-Rør delt Brintstrømmen i to; dene ledededes igennem det glass, the blev belyst, dene igennem et tilsvarende control glass, the stod i en høj og snæver Blikcylinder, som skærmede det imod Lyset.

Until Trods for, at Bacteriernes Vitality kan lide ved et longer Ophold i distilled Vand, har jeg foretrukket at Opslemme dem i Stedet for i en Opløsning af Chlornatrium, for which that kan spaltes af Lyset, before det for Bacteriernne skadelige Chlorine

frigeres. Each has omhyggelige Kontrolforsøg overbevist mig om, at Bacterierne ingen Skade tog ved Opholdet i Vandet.

To Belysningen they used a bulb with 35 amps and 51-49 volts, including a finsens concentrator with 114/2 cm. Apart from the rest of the lens and the positive design Spids. Test tube set attached vinkelret paa Lyskeglens Akse. Det Sted, before that met test tube sets Forflade, ligger 140 mm. from the center of the concentration apparatus, the first lens and 40 mm. udenfor Brændpoints; Lyskeglens diameter here he 18 mm., altsaa noget større end test tube sets, which he 16 mm. Jeg har valgt at attaching test glass set udenfor Brændpunktt, for the Lyskeglen her har et regularly rounds Tværsnit med omtrent samme Lysstyrke overalt.

Near Belysningen var sluttet, tog each 1 cm. 3 Vædske fra hvert test tube, fortyndede in forskellige Forhold med distilled Vand, og foreign Spredningskulturer til Tælling af Bacterierne.

Hojden af Vædskesojlen in Reagensglasset var ca. 25 mm., Altsaa omtrent 1/2 Gange saa stor som Lyskeglens Diameter. Hvis Vandet ikke var blevet holdt i stærk Bevægelse ved at Luften boblede igennem det, vilde derfor til Stadighed en stor Del af Bacterierne have været i Skygge. Bacterierne bleve vel not all belyste necessary long length, men de bevægedes dog all ind i Lyskeglen og atter ad af den.

Ogsaa af en anden Grund customer bacteria come til at ligge i Skygge. The building overload in Vædske i et test tube fungerer nemlig som a convex cylindric lens. Straaler, the træde ind i Reagensglaset, brydes derfor saaledes, at de blive mere convergent; as a result of coming from Vædsken along the test tube set Sider towards the line in Skygge, on a street for their Indtrædelse that are parallel or convergent; derimod vil det helt kunne undgaas eller i hvert Fald indskrænkes betydeligt, naar de ere divergente. Hvis der under these Forsøg, trods Straalernes Divergens, found ubelyste or svagt belyste Afsnit af Vædsken, for hindrede Luftboblernes Bevægelse af Vandet, at Bacterierne bleve liggende her.

With the beskrevne Fremgangsmaade can one vel ikke opnaa ganske nøjgtige Results, men da Formaalet med Forsøgene i første Række var at faa afgjort, om Lyset overhovedet kan dræbe Bacterier, naar de ikke have Adgang til Ilt, var det tilstrækkeligt at konstatere, om de aftoge i Antal under Belysningen. Here you see sig, at dette var Tilfældet, because Fremgangsmaade desuden kunne bruges til rent tilnærmelsesvis at bestmme, before stor Forskel he paa Lysets bactericide Virkning, naar der Ilt til Stede, og naar dette ikke er Tilfældet.

For hindre, at Bacterierne toge Skade ved Opvarmning, lod jeg under Forsøget stadig Koldt Vand stromme ned over Reagensglasset Væg. Som the following Forsøg viser, opvarmedes Vandet i Reagensglasset forøvrigt kun lidt, selv om jeg ikke tog denne Forholdsregel: Each ledede Brint igennem distilled Vand i to test tube og udsatte det ene for Lys af den ovenfor angivne Styrke. Winkler's absorption apparatus var anbragt i et Bægerglas med Vand, som ikke fornyedes. For Belysningens Begyndelse var temperatures at Vandet i Drechsels absorption apparatus 17", at Vandet i Bægerglasset 17°, Stuetemperaturen 170. After 50 Minutes Belysning were these temperatures henholdsvis 20", 21° and 24°. Vandet i det belyste test tube var 32° warmed, det i det ikke belyste 24° Ved 50 Minutes Belysning steg Vandet temperature oldsaa kun 8°, the ikke stromde cold Vand ned over test tube set.

Forsøg No. 1. 1976 1900.

Gennemledning af Brint.

To test tube with 4 cm. destilleret Vand i hvert kogtes i Kochs Dampfsterilisationsapparat, for at uddrive den absorbered air af Vandet. Straks derefter refunded the Vatpropen with a rubber prop, previously the route to Glasrør, which was lost with Vatprop in the end; that one does not hold to the Bunden, that and that kun gennem Proppen. I the corresponding 5/4 Time lod jeg Brint boble igennem Vandet; for at jeg straks kunden begynde med ren Brint havde jeg holdt Udviklingen af den i Gang i de foregaaende 2 timers. For ikke at faa Glasset fyldt med atmosfærisk Luft maatte jeg undgaa at tage Gummiproppen af for at saa Bacterier i Vandet; For this reason, a Pasteurs pipette with 3-4 drops of cultures in their own glass tube. The culture that was used was a 20-timer broth culture of Stafylococcus pyogenes aureus, which was filtered on its own filter paper. I de the following 20 minutes lod each Brint boble own vandet in begge test glass. Under continued Brintgennemledning gennem begge belystes derefter det ene af the i 50 minutes. Forseget var iøvrigt arranges halledes, som jeg har beskrevet ovenfor.

21/6 vare Spredningskulturerne voksede ud. The number of colonists found in Fortyndingen 1:1000 from the best glass and in Fortyndingen 1:10,000 from the control glass set, which also havde været med Brint, men havde staaet i Mørke.

Bacterierne vare oldsaa longtfra all dræbte ved 50 Minutes Belysning under this Forhold, men dog saa kendeligt aftagne i Antal, at det alene ved dette Forsøg kan begtes som fastslaaet, at Lyset kan dræbe Bacterier ogsaa uden Iltens Medvirkning

3

3

Forsøg No. 2. 24/6 1900.

a. Generation of atmosfærisk air.

En broth culture on Stafyloc. pyog. aur. filterredes; 2 Draaber førtes over i 100 cm. distilled Vand. 1 cm. 3 heref fortes over i 2 test tubes with 3 cm. distilled Vand i hvert. Samtidig med at the ledede atmosfærisk air own vandet in dem begge, belystes det ene i 5 minutes; det andet stod i Mørke. Forsogets

. Ordering of the oven for description.

Results at Tællingen var the following:

3

Det i 5 Minuter belyste test tube. Ufortyndet

48 colonists, compared to 48 bacteria i 1

cm. 3 vans Fortynding 1:10

4

svarende to 40 bacteria i 1

cm. 3 vans 1:100

0

3

control lens set. Fortynding 1: 10,000

39 colonists, equivalent to 390,000 bacteria

il cm. 3 vans 237

svarende til 237,000 bacteria i 1 cm. 3 vans

Fortynding 1:1000

b. Gennem ledning af Brint.

The benyttedes samme kultur som til det foregaaende Forsøg (No. 2 a). Fremgangsmaaden var ganske den samme som ved (Forsøg No. 1. Brinten boblede gennem det sterile destillerede Vand i 2 Timer; efter at der var ført nogle Draaber ufortyndet Kultur ned i dette, ledede der atter Brint igennem det i 35 Minuter; Belysningen varede i 1 time.

Tællingen 26/6 gave the following result:

Det i en Time belyste test tube. I 1 cm. S ufortyndet Vand O colonists.

control lens set. Fortydingen 1:1000

152 colonists, svarende til 152,000 Bak

inside 1 cm. 3 vans 15

svarende to 150,000 bacteria i 1 cm. van

Fortydingen 1: 10,000

3

3

Forsøg No. 3. 28/6 1900.

Gennemledning af Brint.

I tre test tube, hvert med 4 cm.: distilled Vand, saaedes en Øsken af en filtreret Bouillonkultur af Stafyl. pyog. aur.; Straks derefter benyttedes 1 cm.fra et af dem (a) til Spredningskultur i Agar. Efter at de to other paa sædvanlig Maade ware for synede with Gummiprop and Glasrør with Vatprop, led by the Brint own the i 18/4 Time; forinden havde Brintudviklingen været i Gang i 1 Time. If the stadig ledede s Brint igennem dem begge, belystes det ene (b) i 1 Time under samme Forhold som ved Forsøg No. 2; det andet (c) stod i Mørke. Derefter lavedes Spredningskulturer.

Tællingen gave the following result:

a. Ved Forsøgets Begyndelse: Fortyndingen 1: 10,000 121 colonists, svarende til 1,210,000

Bacteria i 1 cm.3 Vand. 1:50,000

24

Svarende to 1,200,000

Bacteria i 1 cm. van 1:500,000

2

svarende til 1,000,000 bacteria i 1 cm.3 Vand.

3

b. Efter 1 Times Belysning i Brint. Ufortyndet

109 colonists, svarende til 109 bacteria i

1 cm. 3 vans Fortydingen 1:10

9

svarende to 90 bacteria i

1 cm. 3 vans 1:100 1st

Svarende to 100 bacteria i 1 cm. 3 vans

3

c. Control lens set with Brint. Fortydingen 1:10,000 70 colonists, svarende til

to 700,000

Bacteria i 1 cm.Vand. 1:100,000 18

Svarende to 1,800,000

Bacteria i 1 cm. van 1:1,000,000 6

svarende to 6,000,000 bacteria in 1 cm. 3 vans

3

Forsøg No. 4. 11. 1900.

Generation of atmosfærisk air.

I 4 test tube, hvert med 4 cm.: distilled Vand, saaedes 2 Øskener af and filtreret 45 timer gammel bouillon culture af Staf. pyog. aur. Meeting on the forsynedes with rubber prop and glass; the boblede atmosfærisk air own Vandet, medens de belystes i henholdsvis 2, 5 og 10 Minuter under samme Forhold asm ved Forsøg Nr. 1. Det fjerde test tube var control glass.

Tællingen 14/8 gave the following result:

a. That ikke belyste glass. Fortyndingen 1:1000 305 colonists, svarende til 305,000

Bacteria i 1 cm.: Vand. 1:10,000

31

svarende til 310,000 bacteria i 1 cm.3 Vand.

b. Det i 2 Minuter belyste glass. Ufortyndet

161 colonists, svarende til 161 bacte

rier i 1 cm.3 Vand. Fortydingen 1:10

svarende to 200 bacteria in 1 cm.3 vand.

3

c. Det i 5 Minuter belyste glass. 1 l cm.2 ufortyndet Vand foundtes 57 bacterium.

i.e. Det i 10 Minuter belyste glass. I 1 cm. ufortyndet Vand fandtes () bacterium.

3

Hovedformaalet for these Forsøg var at paavise, om Lyset overhovedet formaar at dræbe Bacterier, naar de ere udelukkede fra atmosfærisk air. All that is said for the first Forsøg visit, at which he Tilfældet, idet omtrent de ni Endedele af Bacterierne dræbtes ved 50 Minutes Belysning. De sere Forsøg have confirmed that, men have paa den Anden Side yderligere vist, at Bacterierne dræbes meget long summers, near the ledes Brint igennem det distilled Vand, hvori de ere opslemmede, end naar der ledes atmosfærisk Luft igennem det. Nogen nøjagtig Fastsættelse af, hvor stor Forskellen er, kunden ikke opnaas paa Grundaf den noget primitive Maade, hvorpaa jeg havde arranges Forsøgene, hvad den bakteriologiske Side angaar, netop for at faa de fysiske forhold saa favorable som muligt. Ved the following Række Forsøg har jeg prøvet at faa nøjagtigere oplysninger herem.

II. Række.

Belysning af bacteria paa Overfladen af almost Nærings

substrate i test tube. Forsøg No. 1. 15/8 1900.

I nogle test tube af 16 mm.'s diameter fyldtes 0.3 cm.% af en Blanding af 9 Dele Agar og 1 Del Gelatine; Denne var iblandet for at formindske Mængden af Fortætningsvand. Glassene lagdes næsten vandret, saa at Næringssubstratet efter Stivningen then and en small and tynd Stribe af ca. 1 mm.'s Tykkelse paa det tykkeste Sted. En Øsken med in filtreret 24 timer gammel broth culture of Stafylococcus pyogenes aureus førtes hen over Agarens Overflade. Glassene lagdes i Termostat ved Legemtemperatur i "); Time, indtil Fortætningsvandet og Bouillondraaben vare fordampede.

Et af Glasene for synedes with Gummiprop, beforehand to Glasrør, and kort og et longer, the next closest to the test tube set Bund; det long Rør var forsynet med Vatprop. Forud for Forsøgets Begyndelse holdt jeg Brintudviklingen in Gang i 3 Timer for at faa den atmosfæriske Luft uddreven af Apparatet. For sure mig, at the ikke trængte atmosfærisk air ind gennem det korte Glasrør, forsynede jeg dette med en Gummislange, the slope nedad.

Forsøget ledesdes med, at Brinten ledesdes ind igennem the long Rør in Reagensglasset in 23/4 Time; derefer belyste each culture in 1 time, with the Brinten stadig stromde gennem Glasset. Belysningen foregik paa samme Maade that ved the foregaaende group Forsøg (see p. 20). Test tube set uses the side, hvor agars laa, and imod concentration apparatus. Lyset gik oldsaa own test tube set Væg og the tynde Lag Agar, in den met bacterium. Efter Belysningen forsynedes Reagensglasset med Vatprop og stilledes i Termostat ved 370,

The other, until the test tube, which has been connected in more Skuffe under the Forsøg, belystes derefter, lukkede med Vatprop, altsaa under saadanne Forhold, at Bacterierne vare i Berøring med atmosfærisk Luft, men iøvrigt paa samme Maade som ved det foregaaende Forsog. Ogsaa de stilledes i Termostat efter Belys

. ningens Afslutning.

Naar saadanne Kulturer vokse ud, then bacterierne et jævnt og tæt Overtræk paa den Del af Agarens Overflade, which ikke he belyst; paa the little belyste Plet finds derimod, old efter Belysningens Varighed og Intensitet, enten et tyndere Overtræk, eller isolerede, mere eller little tætstaaende colonizers, or eventually slet ingen colonizers.

17/vare Kulturerne udvoksede.

1) Belysning i Brint. Efter 1 Tim. Belysn. Ingen Coloner.

2) Belysning i atmosfærisk air. Efter 3 min. Belysn. In the colony, he said over healed the be

Lyste Plet. 5

Ingen Coloner. 10

do.

Result: Ved Belysning under de specified Forhold three Bacterierne ved højst*) 1 Times Belysning under Brint and ved 3-5 Minutes Belysning under atmospheric air.

Forsøg No. 2. 13), 1900.

Fremgangsmaaden var den samme ved foregaaende Forsøg, med den Forandring, at medens Bouillondraaben paa Overfladen af Agaren fordampede, stilledes Reagensglasene i ", Time i et Cylinderglas with sleben Glasprop og med Chlorcalcium i Bunden.

Brintudviklingen holdtes i gang i'. Time for Brintapparatet blev sat in Forbinderse with test glass set. Brinten ledede igennem dette i 2'/, Time for Belysningen started. Because of this, the pair are the same Maade as for the Forsøg.

14/, vare Kulturerne udvoksede.

9

1) Belysning i atmosfærisk air. Efter 1 min. Belysn. Ingen Tydelig Virkning. 3

Many colonists, jævnt demanded over hele

the belyste plet. 5

Bacterierne ere dræbte in the middle of the belyste Plet; ved then edge finds en Del colonier.

2) Belysning i Brint. Efter 1/2 Tim. Belysn. The find omtrent samme Antal Kolo

No more than 3 minutes Belysning

under atmosfærisk air. Result: Ved Belysning under the same Forhold as i foregaaende Forsøg third bacteria not held by 5 Minutes Belysning in atmospheric air.

Ved / Times Belysning i Brint opnaaedes omtrent samme Virkning som ved 3 Minutes Belysning i atmospheric air.

2

*) Since the kun blev udført et Forsøg, he det ikke udelukket, at Bacterierne ogsaa customer være blevne dræbte ved kortere Belysningstid.

som

Forsøg No. 3. 157, 1900.

Fremgangsmaaden var den samme ved foregaaende Forsøg.

Brinten ledes hen over Kulturen i 23/4 Time, inden Belysningen started; forinden havde Brintudviklingen været holdt i Gang i ", Time.

Class 6 Em. Undersøgtes Kulturerne.

16

9

1) Belysning i atmosfærisk air. Efter 4 min. Belysn. - The foundtes en Del Colonier, spredte over

hele the belyste Plet, flest ved Randen. - 5

Ingen Coloner.

2) Belysning i Brint. Efter 3/4 Tim. Belysn. Same Udseende after 4 minutes

Belysning i atmosfærisk air. Result: Under the same Forhold as i de to foregaaende Forsog third Bacterierne ved 4-5 Minutes Belysning i atmospheric air, men ikke ved 45 Minutes Belysning i Brint.

Every time we are told that it is still the same for the Forsøg, it means that there is an extension that goes straight to the same Maade. This one, which can have varied, he Antallet af the bacteria, which was indtørrede paa Overfladen af Agaren, together with those Tykkelse og dermed dens Absorption af chemical Straaler. Men ifølge de Undersøgelser, jeg har beskrevet H. VII p. 48 o. flg. har bacteriernes Antal ingen Indflydelse paa Kulturens Modstandskraft, naar de ligge paa Overfladen af Næringssubstratet, og eftersom der i alle Tilfælde var 1/3 cm. Agar in Reagensglasset, kan variations af Agarlagets Tykkelse kun have været saa ringe, at man kan load the ude af amount

The results of these tests are clear because bacteria (Stafylococcus pyogenes aureus) are overflowing and the Lag Agar-Gelatine is longer than the Indvirkningen concentration of Lys, which is longer when the test tube is exposed to the atmosphere. I forest Tilfælde dræbes de, near Forseget

ordnes saaledes som jeg har beskrevet, ved 1 Times Belysning, men ikke ved 3/4 Times Belysning; i sidste Tilfælde gaa de til basically allerede ved c. 5 Minutes Belysning.

Lysets Virkning paa bacteria, which ere i Berøring med Brint, forholder sig altsaa til Virkningen paa en Kultur, which he i Berøring med atmospheric air, omtrent as 1:10 ved then Ordning af Forsøgene.

III Række.

Belysning af Bacterier, the vare indtørrede paa Bjærg

crystal loader.

De to Forsøgsrækker, jeg hidtil har omtalt, ere udførte paa en saadan Maade, at Lyset blev berøvet de yderste ultraviolet Straaler ved at gaa igennem Væggen af et test tube, inden det met bacteria. Denne Ordning af Forsøgene har bl. a. den Fordel, at ved the efterlignes saa vidt muligt Forholdene ude i Naturen, idet Glas har omtrent samme Absorptionsevne overfor ultraviolet Straaler asm Atmosfæren (Straaler, who have under 350—300 uu Bølgebredde, absorberes). Elektrisk Buelys, which he gaaet own glass, indeholder derfor omtrent de samme Straalearter asm Sollys, om end i et noget andet Mængdeforhold. When you use the electric Lys, you have the required command at work with a constant Lys, which requires muliggør Maaling under the same Forhold Dag efter Dag i en longer Forsøgsrække. One should state that this is the case when using this ordering before using the completely inconstant Sollys.

Paa reason af den interest, which i de senere Aar, tildels af practical reasons, har samlet sig om de ultraviolet Straalers Virkning, har jeg ikke mig tilfredsstillet ved en Forsøgsrække, before then var ladet ude af amount. The following Række Forsøg has therefore undersøgt Virkningen on all the Straalarter, som the elektriske Lys indeholder, ved at reimburse Glasset with Bjærgkrystal, so that it is passabelt for Straaler with indtil 200 uu Bølgebredde.

Ogsaa til this Forsøg has any applicable Stafyl. pyog. aur. De Plader, the skulde belyses, har jeg tilberedt paa den Maade, which he describes H. VII p. 51 (Metode No. 2, Indtørring af Bacterierne direkt paa Bjærgkrystalplader). It is usually the case that potato cultures are used for these same substances that are mixed with the results of bacteria. After that , when the potatoes are over and the test tube is rented, the distilled glass is held over the glass and glass, to the glass. The result is that there is a filter on the filter paper and with a Platinøsken on Draaber paa Bjærgkrystalplader on 0.5 - 1 mm.'s Tykkelse and 22 x 22 mm.'s Størrelse. This is requested in the Petri Scale, which is still in the et Skab Natten over, with Draaberne fordampede. Naar Forsøget skulde begynde, lagde jeg Bjærgkrystalpladerne hen over de fire Kamre i et Apparat, which he described in the doctoral handling p. 18 (Apparatus No. 6). De kittedes fast med Ungventum cerae. Efter Belysningens Afslutning dakkede each bacterium with Draabe Agar; Derefter lagde jeg Bjærgkrystalpladerne over two additional cameras that are still in the thermostat.

Ved at lade Bacterierne indtørre direct paa en Bjærgkrystalplade opnaas the relevant fordelige. As a matter of fact, if you have anført H. VII p. 40, Maalingen can Maalingen af Lysets bactericide Virkning kun blive nøgtig, to the anvendes fasten Næringssubstrater; Men da Ilten diffuser langsomt ud af disse, og da det ikke er udelukket, at der kan frigøres Ilt ved at Lyset frembringer kemiske Processer in dem, er det ikke heldigt netop ved Forsøg af because Art at have bacteria liggende paa eller i Næringssubstratet. The safe rest helt at undgaa, at Bacteria there are in Berøring with Næringssubstrat under Belysningen, and forest at tillsætte the efter Forsøgets Afslutning. Ved the order, each has brugt, its bacteria in direct contact with the flowing Brint, and which it intet, som kan holde absorberet Ilt. Saa snart Luften i Kamrene er iltfri og det vil den hurigt blive paa reason af deres Lidenhed he ikke mere Ilt tilbage. That he sikkert in ganske overdreven Forsigtighed, at each har ledet Brint igennem Kamrene saa Længe, som har given under Beskrivelsen af de Enkelte Forsøg.

This is the first step towards the formation of Brinten with Ilt, which is complete, in the event of decomposition of the bacteria and in the event of infection with the same Lysets of bactericides in Virkning. Om noget saadant foregaar ved jeg ikke, men i hvert Falder det ifølge Sagens Natur umuligt at undgaa det, og under all omstændigheder vil det dreje sig om forsvindende Mængder i forhold til den stadige kraftige Brintstrom.

Om Indsugning af Ilt igennem det Lag af Ungventum cerae, hvormed Bjærgkrystalpladerne vare klæbede almost til brass blocks, har der ikke kunnet være Tale; dels var Blokken nedsænket i Vand, dels var der Overtryk inde i Kamrene, idet den Gummislange, hvorigennem Brinten strømmede ud, var ført ned i et Vandlag af et Par ctm.'s Højde; herved opnaaede jeg desuden at forhindre, at der kom atmosfærisk Luft ind i Slangen. Finally, større Overtryk approx. 15-20 cm. var the i Udviklings- og Rensningsapparatet together with the forskellige rubber slanger for Kamrene, idet the var anbragt en Vatprop i the tilførende brass tube.

The Forsøgsordning, which has already been applied, has now the Fordel, at intet af Lyset absorberes in den træffer Bacterierne, idet det kun gaar igennem Bjærgkrystal og distilled Vand, og begge these materials are permeable for ultraviolet rays.

For using the velvety Belysning af fire Bjærgkrystalplader to spare Tid, har jeg brugt en Fremgangsmaade, som lettest forklares ved et Eksempel. Hvis de tre Plader belyses in 10, 20 og 30 Minutes og den Fjerde benyttes til Kontrolkultur, bebrgt any for Belysningens Begyndelse en Draabe Asfaltlak paa then sidste paa den Side, which used imod Lyset, halledes, at the skyggede for bacteria; After 10 minutes Belysning applied jeg a Draabe paa en anden Plade; Belysningen continued only 10 minutes, before that it was applied in Draabe paa den tredje Plade 0. S. v.

Ved det H.VIIS. 38 beskrevne Forsøg har jeg.paavist, at de kelte Individual i en Bacteriopslemning have forskellig stor Modstandskraft. It's all the same to you, to your belyser bacterium, which is indtørrede paa en Plade. In culture, which ikke he belyst, then, naar which he vokset ud, et tæt, hvidligt Slør, i hvilket ikke kan skelnes enkelte colonists. The first Trin af Vitalitetens Svækkelse ved Belysning betegnes ved, at the then colonists, som staa saa tæt ved hverandre, at its edge next berøre hinanden, selv naar de ere saa smaa, at de kun nettop kunne ses. Hvis Belysningen har varet last longer, then the isolated colonists with noget større Mellemrum. Eventually after Belysningen you will end up being stronger or longer, bliver the kun ganske

saa

faa bacteria tilbage; On the har imidlertid Flertallet en betydelig Modstandskraft, at whose Antal holder sig omtrent uforandret selv igennem strærkt stigende Belysningstider. These transitions are saa tydelige, at which one can være in Tvivl om, until there is a risk of the requested group one should be active in culture.

I de Forsøg, the original p. 45 of, has only been described in Draabe distilled Vand, has the var opslemmet bacteria, and first towers after Belysningen. Imod because Fremgangsmaade kan the imidlertid indvendes, at which he vanskeligt at uddrive the atmosfæriske air, which he absorbs in Vandet. For this reason, there are rules foretrukket at towers for Belysningen.

Since that, saa vidt jeg ved, tidligere he foretaget Belysningsforsøg paa denne Maade, har jeg set det for nødvendigt at udføre nogle Kontrolforsøg. Jeg has forsøgt at faa the following Spørgsmaal besvarede:

1) Days of bacteria Skade ved at the atmosfæriske air uddrives?

2) Days of bacteria Skade ved Indtørring?

At that it is not Tilfældet, har jeg oversight mig om ved i different Forsøg at have en Kontrolkultur; These are all scheduled and the following day. Desuden har jeg udført the following Forsøg, ved hvilket ledede Brint hen over Dækglas med indtørrede Bacterier i 34/2 Time, dvs i longer Tid end in noget Belysningsforsøg; These bacteria and others, however, are not related to Brint, dried with agar and cultures still in the thermostat. The next day is all cultural events and; the var ingen Forskel paa Vækstens Styrke.

Kontrolforsøg No. 1. 28/4 1901.

25/4 Kl. 11 Fm. opslemmedes en 15 timer gammel upigmenteret potato culture af Staf. pyog. aur. i distilled Vand; Draaber afsattes paa Bjærgkrystalplader. These lagdes i Petris Skaale, som stilledes i Termostat ved 370 to 27. Kl. 11 fm. (48 timers); Derefter stod de i et Skab til 28/4 Kl. 19%, Em. (264/, Time), because there were 4 on the over pair the side 30 omtalte Blechblok. Fra Kl. 1.40 to 5.10 (3'/Time) ledede jeg Brint hen over dem, medens de laa i Mørke; Brintudviklingen havde forud været i Gang i 20 Minutes. These 4 signs and 3 others, which do not have været required for Brintens Paavirkning, for synedes with Agardraaber and lagdes paa Bøttchers fugtige Kamre, which derefter stilledes i Termostat ved 37o.

Next day (29/4 cl. 9 fm.) var der kraftig, ens Vækst paa dem alle.

That Forsøg viser not alene, at the bacterierneart, each har anvendt, not tager saa megen Skade ved at berøves Adgang til atmospheric risk air in nogle Timer, at det kan ses umiddelbart paa en Kultur, men ogsaa, at Bacterierne kunne taale Indtørring i 78 Timer . That is, you need to pay for a change and vent, after the Staf. pyog. aur. can be seen in Brint and the long Tids Indtørring; bl. af Hensyn hertil har jeg valgt at experimentere med netop denne Bacterieart. Ved mine Forsøg bliver the tilmed ikke Tale om fuldst æ ndig Indtørring, idet Bacterierne enten have Adgang til den Vanddamp, som Luften indeholder, eller ere i Berøring med dampmættet Brint.

3) He bacterium's Modstandskraft mod Lyset afhængig af, om de have været indtørrede i kort eller long Tid?

However, there is a need to worry about bacteria that are present in the length of the length of all the samples, you need to hunt for them if you cannot overhold them. The following information is visible, at which he is ligated for bacteria Modstandskraft mod Lyset, om de have været indtørrede i 2 or i 26 timers.

Kontrolforsøg No. 2.

18/6 Kl. 4 Em. laves en Opslemning i distilled Vand af en 18 Timer gammel potato culture af Staf. pyog. aur. - filter ring. Fortynding med distilled Vand. The føres Draaber over paa Bjærgkrystalplader. These are long in the Petris scale, som still in the thermostat Kl. 5. Halvdelen sates Kl. 7 paa Bøttchers Kamre. Belysning with 20 amps, 5149 volts, 60 cm.'s distance between Kulspidsen and Bjærgkrystalpladen; Temperatures at Vandet i Fotokteinometret = 200. — Efter Belysningen dakkes Bacterierne med Agar.

thermostat.

19

6

The other Halvdel af Bjærgkrystalpladerne stod i et Skab til Kl. 7 Em. (24 timers), because the belystes under samme Forhold. 6 underestimated cultures.

22

3

a. Indtorrede in 2 timers. control culture

gathered the colonists. Efter 1/4 min. Belysn.

do. 1/2

tætst., next collecting colonists. 14

do.
1

tætstaaende, isolated colonists.
do.

do.
2

0 colonists. 3

3 do

Oh do. 5

5 do. 6

1 do

14/2

about 30

+

142

b. Indtorrede in 26 timers. control culture

gathered the colonists. Efter 1/4 min. Belysn.

do. 1/2

tætstaaende, isolated colonists, i Midten

cumulative. 3/4

tætstaaende, isolated colonists. 1

do.

isolated colonists, ca. 20. 2

11 colonists. 3

1 do 4

10 5

0 do. Result: The bacterium, which has været tørre in 26 timers, has the same Modstandskraft as de, which kun has været tørre in 2 timers; i first Tilfælde dræbtes de ved omtrent 2 Minuters Belysning, i sidste Tilfælde ved 1'/:-2 Minuters Belysning.

do.

4) Afhænger Lysets bactericide Evne af, om virker uafbrudt, eller om Belysningen afbrydes nogle Gange i kort Tid, naar blot Belysningsperioderne tillsammen ere ligesaa long as the uafbrudte Belysningstid?

Som omtalt p. 31 har jeg med visse Mellemrum af brudt Belysningen for at anbringe en Draabe Asfaltlak paa et af Dækglassene. Disse Afbrydelser varede about 1 minute. Before it is sandy, the bacteria can generate its vitality when it comes to Skygge in the same time as the Tid, but the dog has the following Forsøg undersøgt, from which it Tilfældet.

Kontrolforsøg No. 3.

24/6 cl. 10 fm. opslemmes en 14 timer gammel potato culture af Stafyloc. pyog. aur. i distilled Vand. filter ring. - Draaber afsættes paa Bjærgkrystalplader. Indtorring and thermostat. Belysning som ved Kontrolforsøg No. 2. Groups a belystes paa Bøttchers fugtige Kamre, groups b paa den sædvanligt used brass blocks. Kulturerne undersøgtes ??/6.

27

3

a. U afbrudt Belysning. Efter / Min. Belysn. gathered the colonists. 12

do. tætstaaende, isolerede, næsten sammen

smelting colonists. 1

do.

do. 2

do. 3

do. 4

do. 5

17 colonists. 7

3 do 10

0 do. control culture

gathered the colonists. b. Afbrudt Belysning.

Brackets betegne en group af + culture, the belystes velvety cantle 1/4 min. Belysn. gathered the colonists. 112

do. 3/4

do. 1

do.

Efter 1/2 min. Belysn. tætstaaende, isolerede, næsten sammen

smelting colonists. 2

do. 3

do. 4.

tætstaaende, isolated colonists, ca. 50. 5

do. 7

12 colonists. 10

1 do control culture

gathered the colonists. Result: Ved uafbrudt Belysning third bacteria about 4—5 minutes, ved afbrudt Belysning about 5—7 minutes.

Forskellen mellem the uafbrudte og the afbrudte Belysning he oldsaa saa ringe, at the kanlades ude af Mengetning. Selv under uforandrede Forhold he nemlig Forsøgenes Results ikke saa constant, at man kan tillægge saa smaa Forskelligheder nogen Betydning.

5) Afhænger Bacterernes Modstandskraft af, before many individuals who finds i den Opslemning, before Draaber afsættes paa Dækglassene.

Kontrolforsøg No. 4.

30/6 Kl. 9 Em. laves der en meget tæt Opslemning af en Kartoffelkultur af Staf. pyog. aur. filter ring. – Der laves en Fortynding 1: 10; the har omtrent samme Blakninggrad som de sædvanligt benyttede Opslemninger. – Draaber dels heraf, dels af den ufortyndede Opslemning afsættes paa Bjærgkrystalplader. Indtorring ved Henstand i et Skab om Natten. - 1/7 Belysning som ved Kontrolforsøg No. 3.

a

14/2

a. Ufortyndet Opslemning. Efter 1 min. Belysn.

gathered the colonists.

do. 2

do. 211. 3

do. tætstaaende, next collecting colonists.

do.

effekt

Efter 5 min. Belysn. tætstaaende, næsten sammensmeltende

colonizer. 6

do.

(over 100). 8th

do.

do. 10

7 colonists.

0 do. 15

Oh do. 20

0 do. 30

0 do. control culture

gathered the colonists. Result: bacteria dræbtes ved 8-10 minutes Belysning.

12

21/2

Fortyn thing 1:10. Efter 1 min. Belysn. gathered the colonists. 11,

do. 2

do.

do. 3

tætstaaende, næsten sammensmeltende

colonizer. 4

2 colonists. 5

11 Thurs. 6

2 Thurs. 8th

1 do 10

Oh do. 12

Oh do. 15

0 do. Result: Bacteria dræbtes ved 3–4 minutes Belysning.

Naar Opslemningen indeholder faa Bacterier i hver cm.}, dræbes this oldsaa lettere, end naar den Indeholder mange.

Paa Grund af denne Fejlkilde gaar det ikke an at gøre en Række Forsøg med atmosfærisk Luft en Dag med en Kultur, og en Række Brintforsøg en anden Dag med en anden Kultur, hvilket vilde være det nemmeste. Each has therefore used the same Opslemning to a Række Forsøg with Brint and a Række with atmosfærisk air. After that, there is more information about Maade. he det ligiglied, om Kulturens Modstandkraft he forskellig paa de forskellige day. Hvad that comes to a pair, at which there is a bacteriernes Modstandskraft in Brint and in atmospheric air altid bliver the samme or omtrent the samme, to Forsøgsordningen he ens; smaa Variationer maa man være forberedt paa at find ogsaa heri.

som

to

here

6) Have bacteria with the same stamina i ter Tilstand,

en

opslemmede i distilled Vand?

Kontrolforsøg No. 5.

22/5 Kl. 1 Em. opslemmes en 25 Timer gammel potato culture af Staf. pyog. aur. i distilled Vand. Filtering Draaber føres over paa Bjærgkrystalplader. Halvdelen af disse (group a belyses straks paa Bettchers

Kamre. Lysstyrke: 25 Amp., 51-49 Volt; 60 cm. Distance; 200. Derefter lægges de i Petris Skaale, til Draaberne ere fordampede, hvorpaa Bacterierne dækkes med Agar.

Den anden Halvdel af Bjærgkrystalpladerne (group b) lægges 22/5 Kl. 11/2 Em. i Petris Skaale, som stilles i Termostat, til Draaberne ere fordampede; derefter staa de i et Skab til 3. Kl. 10 fm., Since the belyses paa samme maade som the first hold. kulturerne undersøgtes 25th class 1st em.

a. Bacterier opslemmede i en Draabe distilled Vand control culture

gathered the colonists. Efter 1 min. Belysn.

do. 2

do. tætstaaende, næsten sammensmeltende

colonizer. 4.

do. 5

do. 6

6 colonists. 9

3 do 12

3 do 15

Oh do. 20

1 do Result: Bacteriernne dræbtes ved 6 Minutes, men ikke ved 5 Minutes Belysning.

+

b. Tørre Bacterier (about 20 timers Indtørring). control culture

collected the colonists Efter 1 min. Belysn.

do. 2

do. 3

tætstaaende, next collecting colonists.

do. 5

tætstaaende colonists; i Midten kun faa

colonizer. 6

16 colonists. 9

15 Thurs. 12

7 do. 15

0 do. 20

1 do Result: Bacteriernne dræbtes ved 6 Minutes, men ikke ved 5 Minutes Belysning.

Bacteria have the same resistance to resistance in the pot, so that they are opslemmede in the distilled Vand*).

*) Der foreligger fra tidligere Tid en Del Undersøgelser af dette Spørgsmaal, men de ere ikke saa overbevisende, at jeg har turdet undlade at gøre Kontrolforsøg.

De Forsøg, which is followed by Tizzoni and Cattani, Billings and Peekham including Celli and Santori bevise intet. This forskere is also called Silketraade, the vare dyppede i Bouillonkulturer. At Sollyset vanskeligt eller slet ikke customer sterilisere Silken he noget selvfølgeligt, after some bacteria in Traadens Indre skærmedes mod Lysets Paavirkning.

Downes and blunts do not have anything to do with the state, at bacteria i tør Tilstand can dræbes af Lyset, men undersøgte ikke, om de have større eller little Modstandskraft, end naar de ere opslemmede in en Vædske.

De eneste Forsøg, who have bidraet til at Løse Spørgsmaalet, ere LedouxLebard's, Kruses, Gaillards og Duclau x's. The result of this is implied in indbyrdes afvigende, based on the reason that comes from above and above, before the three signs of the sammenlignende Undersøgelser paa dette omraade: Lack of constant Lys.

Ledoux-Lebard skrabede noget af en Agar-Overfladekultur af Difteribaciller og smurte the paa et test tube. Under these Forhold modstode Bacterierne Lysets Paavirkning noget longer, end to de ware opslemmede in the distilled Vand.

Gaillard foundt, at Udtørring forøger Bac. anthracis's stamina required; Known bacteria have very long, f. Ex. more Maaneder, har Lyset kraftigere Virkning paa dem, men selv because he the dog mind end naar de finds opslemmede in en Klar Vædske. Ogsaa Bac, tyfos.'s og Staf. pyog, aur.'s Modstandskraft skal ifølge Gaillard forøges lidt ved Tørring i kort Tid. Longer Tids Indterring more favorable derimod Lysets Virkning.

Ved this Kontrolforsøg har det vist sig, at the eneste Fejlkilde af nogen Betydning, the knotter sig til Anvendelsen af the beskrevne Fremgangsmaade, he Antallet af Individual i hver cm. 3 af the bacteriopslemning, the benyttes. De andre Forhold, the customer tænkes at have nogen Indflydelse paa Kulturens Modstandskraft, have vist sig at være uden Betydning for denne. When you apply the Forhold rule, som je har omtalt S. 37 - Anvendelsen af samme Kultur til et Forsøg med Brint og et med med atmospheric air -- you can derfor godt benytte denne Fremgangsmaade til Bestemmelse af, hvilken Indflydelse Tilstedeværelsen eller Lacken af Ilt har paa Lyset's bactericidal Virkning.

Ved de the following Forsøg har jeg som nævnt i Begyndelsen af the Afsnit, p. 29 - undersøgt Virkningen af Lys, the indeholder all the ultraviolet Straaler, som kunne gaa igennem Bjærgkrystal, dvs Straaler af indtil 200 uu's Belgebredde.

Belying of bacteria, indtørrede paa Bjærgkrystalplader, in Brint and in atmospheric air.

Forsøg No. 1. Belysning i Brint.

Foreløbigt Forsøg. 224 1901.

The applied one in 13 timers was agar overflade culture on Staf. pyog. aur.

Cultures related to the same Maade as in Kontrolforsøgene. Indtørring af Draaberne i Dessicator med Chlorcalcium i 4'/, Time. – Bjærgkrystalpladerne requested paa

4/2 det p. 30 omtalte Instrument, saaledes at de dækkede dettes 4 Kamre. Generation at Brint in 2/2 time for Belysningen. Under stadig Gennemledning af Brint belyses med Buelys; 20 amps, 51-49 volts, 30 cm.'s Distance from the Bjærgkrystalpladen and middle of the positive Kuls Spids. Temperatures at Vandet and Fotokteinometret dropped under Forsøget from 300 to 20°.

Hvad sporedande bacteria angaar, he Kruse enig med Gaillard; derimod mener han, at Bacterier, der ikke taale Indtørring saa godt (f. Ex. Bac, tyfos.) dræbes lettest i ter Tilstand.

Ogsaa Duclaux, the undersøgte forskellige Mikrokokker, fik the result, at this Modstandskraft overfor Sollys svækkes ved, at de opbevares i tør Tilstand. Kulturerne undersøgtes 26/4: control culture gathered the colonists. Efter 2 min. Belysn.

do. 5

isolerede colonists (about 50th) 10

13 colonists. 15

9

do. Result: Bacteria dræbtes ved 5-10 minutes Belysning in Brint.

NB. Lysstyrken var ikke the same as under the following Forsøg

Forsøg No. 2. Belysning i atmosfærisk air.
Foreløbigt Forsøg. 11, 1901.

Fremgangsmaaden var den samme ved det foregaaende Forsøg, naar day, at Draaberne paa Bjærgkrystalpladerne fordampede, medens disse opbevaredes i et Skab om Natten. Lysstyrken: 25 amps, 51-49 volts, 60 cm.'s distance, Vandets

: Temperature before 20°

Culture undersøgtes 13/5 Kl. 2 Em. Control culture

gathered the colonists. Efter 1 min. Belysn.

do. 14/2

utællelige, isolated colonists. 2

do. 3

20 colonists. 4

11 Thurs. 7

2 Thurs. 10

0 do. 15

1 do 20

0 do. Result: Bacteria dræbtes ved approx. 3 Minutes Belysning in atmospheric air, men ikke ved 2 Minutes Belysning.

Forsøg No. 3. Belysning i Brint og i atmosfærisk air. 1715 1901.

The applicable same Fremgangsmaade as ved det foregaaende Forsøg. The ledede Brint gennem Kamrene i 23/4 Time forud for Belysningen; under stadig Gennemledning af Brint belystes derefter under samme Forhold som ved det foregaaende Forseg. (25 amps, 51-49 volts, 60 cm.'s distance, 20°). Forud for Belysningen af 2det Hold Plader *) ledede Brinten own chamber i 1 time. I Mellemtiden mellem de to Forsøg holdtes Brintudviklingen in Gang.

De Plader, who listens to groups b. (belyste i atmosfærisk air vare under Belysningen anbragte paa Bettchers fugtige kamre.

Kulturerne undersøgtes 197, Kl. 4 Em.

5

a. Belyste i Brint.

Efter 1 min. Belysn.

gathered the colonists. 2

do. 2 det Hold 4

tætstaaende, utællelige kolon. 6

9 colonists. 9

2 Thurs. 12

0 do. 1st hold 15

0 do. 20

0 do. Result: Bacteriernne dræbtes ved 6 Minutes, men ikke ved 4 Minutes Belysning.

14/2

b. Belyste i atmosfærisk air. control culture

gathered the colonists. Efter 1 min. Belysn. tætstaaende, utællelige kolonier.

do. 2

11 colonists. 21/2

3 do 3

8 do.

4 do. 4

5 do. 5

0 do. 6

2 Thurs. 8th

2 Thurs. Result: Bacteriernne bleve dræbte ved 2 Minutes, men ikke ved 1'/: Minutes Belysning.

34/2

*) Ved et Hold Plader forstaar jeg de fire Bjærgkrystalplader, the belystes velvety. For Overskuelighedens Skyld har jeg undertiden i Tablerne nævnet Holdene i en anden Orden end den, hvori de belystes.

Forsøg No. 4. Belysning i Brint og i atmosfærisk air. 29% in 1901.

The applicable same Fremgangsmaade as ved det foregaaende Forsøg. For the ledede s Brinthen over Bacterierne var Brintudviklingen in Gang in 1/2 Time. 1st Hold Plader is 30 minutes, 2nd and 3rd are 20 minutes. Ogsaa under Forsøgene med atmosfærisk air vare Pladerne paa brass blocks; the ledede s atmosfærisk air igennem dennes Kamre.

Culture underestimated 7.

7 •

a. Belysning i Brint.

Efter 1 min. Belysn. gathered the colonists. 2

tætstaaende, next sammen1ste Hold

smelting colonists. 3

17 colonists. 4

5

do. 5

0 do. 6

0 do. 2 det Hold 8

do. 10

do. 12

2 Thurs. 15

0 do. 3dje Hold 20

0 do. control culture

gathered the colonists. Result: Bacteriernne bleve dræbte ved 3 Minutes, men ikke ved 2 Minutes Belysning.

b. Belysning i atmosfærisk air.

Efter 1 min. Belysn. - collected the colonists. 2

*) tætstaaende, delvis sammen1ste Hold

smelting colonists. 4

(Colonier. 6

2 Thurs.

*) Jeg have belyst Pladerne in denne irregular Rækkefølge, fordi ellers vilde det Ophold, jeg benyttede til at sætte Asfaltlak paa Bjærgkrystalpladerne, være blevet longer end det Tidsrum (1/2 minute) som den korteste Belysning varede, og jeg sikker var ikke , at Virkningen paa Bacterierne vilde blive the samme under these Omstændigheder, som ved uafbrudt Belysning.

Efter 11/2 min. Belysn. gathered the colonists. 3

O colonists. 2 det Hold 8

3

do. 10

0 do. 1

gathered the colonists. 24/2

14 colonists. 3the Hold 5

0 do. control culture

gathered the colonists. Result: Bacteriernne bleve dræbte ved 24/2 Minutes, men ikke ved 2 Minutes Belysning.

Results from mine Forsøg he altsaa, at bakterierne adsættes for Lys, the holder of all the ultraviolet Straaler, which can gaa igennem Bjærgkrystal, gør det kun Ring Forskel, om de ere i Berøring med Ilt eller ej. Forsøgsrækkerne No. I og II resultered derimod i, at Lysets bactericide Evne he i høj Grad afhængig af Tilstedeværelsen af Ilt. Rækken No. II, ved hvilken Afhængighedens Grad kunde paavises nøjere, gav som Result, at Bacterierne dræbtes 10 Gange saa speedy i atmosfærisk air som i Brint.

At the sidst beskrevne Forsøgsrække (No. III) has given et result, which he keeps forskelligt here, skyldes utvivlsomt ikke Forsøgsfejl, men the betydelige Forskel paa Fremgangsmaaden ved Forsøgene.

The maximum day in the amount, at Mængden af Lysets ultraviolet Straaler ikke var den samme i de tre Rækker Forsøg.

I lste Række gik Lyset igennem Væggen af et test tube, the absorbered de yderste ultraviolet Straaler, hvis Bølgebredde ligger imellem 350——300 and 200 uu. I 2den Række absor

mu . However, there is no one that is Straaler, but there are blue and purple ones, and the Lyset is for your own test tube set Væg and your own and Lag Agar. I 3the Række forsøg bleve bacteria derimod udsatte for et Lys, which includes all the ultraviolet Straaler, which can gaa igennem Bjærgkrystal (Straaler med indtil 200 un Bølgebredde).

Desuden customer det tænkes at have nogen Betydning, at Bacteria in the first Række Forsøg vare opslemmede in distilled Vand, og i anden Række laa paa en fugtig Agaroverflade, means de i tredje tørre og ikke i Berøring med Næringssubstrat. For at faa afgjort Betydningen af this forskellige Forhold har jeg udført de the following tre Rækker Forsøg.

IV. Række.

Bacterier, opslemmede i distilled Vand, belystes dels i Brint, dels i atmospheric air. Lyset gik kun gennem

Bjærgkrystal and distilled Vand. Formaalet with this Forsøg var at undersøge, om the omtalte Forskel mellem Resulterne af de to the first Forsøgsrækker og den tredje skulde bero paa, at Bacterierne i sidstnævnte vare tørre, medens de i de to the first vare opslemmede i distilled Vand Aagarover eller laatig pa . Opgaven var oldsaa at indrette Forsøgene saaledes, at kun Forskellen i Bacteriernes Fugtighedgrad kom i Geldtning.

Each has the following forward Forsøgene ganske that, who hears to III. Række, med den Forskel, at the Draaber Bacterieopslemning, der bleve afsatte paa Bjærgkrystalpladerne, ikke fordampede, men belystes straks. For dog at faa Forholdene saa ens som muligt, og for at udnytte Fordelen ved Brugen af almost Næringssubstrat, har jeg ladet Draaberne fordampe efter Belysningen og derefter dækket de tørre Bacterier med en Draabe Agar.

Forsøg No. 1.

1976 1901 Kl. 10 Fm. opslemmes en 18 timer gammel potato culture af Staf. pyog. aur. i distilled Vand. filter ring. Draaber afsættes paa Bjærgkrystalplader efterhaanden som these skulle bruges. Straks derefter uden at Draaberne først ere fordampede lægges Pladerne paa Metalblokken. With a lot of brintstrom ledes gennem denes Kamre in 15 minutes for Belysningen af hvert hold. --- Belysning with 20 amps, 51-49 volts; 60 cm. insult; Vandet's temperature 20%. Efter Belysningen lægges Bjærgkrystalpladerne i Petris Skaale, som stilles i thermostat, for at Draaberne kunne fordampe. Saa snart dette he sket, dækkes Bacterierne med en Draabe Agar, Bjærgkrystalpladerne lægges paa fugtige Kamre.

Medens Belysningen i atmosfærisk air foregik, suggested because of its own camera.

Under Forsøget stod Reagensglasset with Opslemningen in Note.

Culture undersøgtes 14/6

a. Belysning i Brint.

Efter 1 min. Belysn. gathered the colonists. 2

do. 1st Hold 4

do.

do. 9

10 colonists. 12

2 Thurs. 2 det Hold 15

1 do 20

1 do Result: Bacteriernne bleve dræbte ved 9 Minutes, men ikke ved 6 Minutes Belysning.

b. Belysning i atmosfærisk air. control culture

gathered the colonists. Efter 1 min. Belysn.

do. 2

do. 3

do. 4

do. 5

tætstaaende, delvis sammensmeltende Ko

lonian. 6

tætstaaende, isolated colonists. 8th

15 colonists. 10

3 do Result: Bacteriernne dræbtes ved 8 Minutes, men ikke ved 6 Minutes Belysning.

Forsøg No. 2.

The applicable same Fremgangsmaade as ved det foregaaende Forsøg. Cultures var 18 timer gammel. Brintudviklingen had to wait in the Gang in 5/4 Time for Forsøget started. Forud for hvert Hold Pladers Belysning ledede Brint hen over Kulturen i 20 Minutes. Under Belysningen in atmosfærisk air sugedes denne igennem Kamrene.

12

0 do. 15

Oh do. 1st hold 20

0 do. control culture

gathered the colonists. Result: Bacteriernne bleve dræbte ved 8 Minutes, men ikke ved 6 Minutes Belysning.

b. Belysning i atmosfærisk air ft. Control culture

gathered the colonists. Efter 1 min. Belysn.

do. 2

do. 1st Hold 3

do. 4.

do. 5

tætstaaende, isolerede Col. 6

do. 2 det Hold

8th

2 colonists. 10

0 do.

Result: Bacteriernne bleve dræbte ved 8 Minutes Belysning, men ikke ved 6 Minutes Belysning.

The visible sign is old, when there are bacteria that are opslem in the distilled Vand, it is their Modstandskraft mod Belysning lige saa lidt afhængig af, om de ere i Berøring med Brint eller med atmosfærisk Luft, som

To the first indtørrede direct paa Bjærgkrystalplader.

Aarsagen til Uoverensstemmelsen mellem Forsøgsrækkerne No. I and II paa den one Side and No. III paa den other Side kan derfor ikke være Forskellen i Bacteriernes Fugtighedgrad. The maa søges i et andet af de ovenfor nævnte Forhold. Ved det Følgende Forsøg Har Jeg Undersøgt, Om Aarsagen Sculde Være, at I 3dje række forsøg VARE Bacterierne Indtør speech Direct Paa Bjærgkrystalplader, Uden NæringSubstrat, Medens de I 2den Række - The Udførtes RefKraft Af Kulturens ModstaSta. – Vare i Berøring med Agar. The customer tænkes, at Lyset fremringer chemical Processer in Agaren, which kræve Iltens

Medvirkning og favorable bacteria Tilgrundegaaen, and which derfor ville bevirke, at which comes to at se ud, som om that var selve Lysets bactericide Virkning, the paaskyndes ved Tilstedeværelsen af Ilt .

For at undersøge, om that he Tilfældet, har jeg belyst en Kultur, Magen til dem, who used i 2den Forsøgsrække altsaa Bacterier paa Overfladen af Agar med det Lys, who used til 3dje Række Forsøg altsaa Lys, der kun var gaaet igennem Bjærgkrystal og distilled Vand.

V. Række.

Bacteria paa Overfladen af almost Næringssubstrat belystes in atmospheric air, in Brint. Lyset gik kun igen

in Bjærgkrystal and distilled vans.

15/, 1901. Jeg benyttede det af Dr. Bang constructed the apparatus, which he described in Meddelelser fra Finsens medicinske Lysinstitut IV, p. En 24 timer gammel bouillon culture af Staf. pyog. aur. Filters and fortyndedes with a line saa stor Portion Vand. Med Vatpensel gned jeg Filtratet ud over Overfladen af Agaren.

Since the scales have 2 timers with the temperature, the Vædsken paa Agarens Overflade is required. On the Skaalene

scrupulous pair of Belysningsapparatet.

Der ledede Brint hen over Overfladen af Agaren i 134 Time ; forud herfor havde Brintudviklingen været i Gang i 1, Time. The belystes med 25 amps, 51-49 volts; temperature 20°; Kulturens distance from Kulspidsen var 60 cm.

Under Forsøgene af groups b suggested atmosfærisk air hen over cultures.

Culture undersøgtes 18

a. Belysning i Brint. Efter 1 min. Belysn. tætstaaende, next sammensmeltende Ko

lonian.

do. 3

do. 4

do. 5

do. 6

talrige isolated colonists, aftagende i An

tal ved stigende Belysningstid. 7

do. 8th

do.

do. 10

do. 12

kun grandson colonists. 15

do.

+ O

b. Belysning i atmosfærisk air. Efter, Min. Belysn. nearest collecting colonists. 1

do.

do. 2

do. 24/2

do. 3

do. 4

do. 5

do. 6

talrige isolated colonists, aftagende i An tal ved stigende Belysningstid. 7

do. 8th

do. 10 kun grandson colonists.

cov

Result: Heller ikke naar Bacterierne ligge paa Overfladen af Agar har det nogen Betydning, om de under Belysningen ere i Berøring med atmospheric air risk eller med Brint.

Aarsage til, at Bacteria in the Forsøgsrække modstod Lysets Indvirkning in betydelig longer Tid, naar de vare i Berøring med Brint, end naar de vare i Berøring med atmosfærisk Luft, kan altsaa ikke søges i, at de laa paa Overfladen af Agar.

Finally he der den tredje Mulighed tilbage: at Uoverensstemmelsen mellem Results af de to første Forsøgsrækker og den tredje beror paa den Forskel i Lysets Indhold af ultraviolet Straaler, som he en Følge af, at det i de to første forsøgsrækker gik igennem Glas, hvorved, If it is more necessary, you will be disturbed by the ultraviolet ray absorbers, by means of the three Forsøgsrække udlukkende gik igennem Bjærgkrystal og distilled Vand. For at undersøge om Aarsagen ligger her, har jeg ved following Forsøg belyst bacterierne paa samme Maade som ved de Forsøg, der hear til 3dje Række, med den Forskel, at Bacterierne vare indtørrede paa Glasplader i Stedet for paa Bjærgkrystalplader.

VI. Række.

Bacterier, the vare indtørrede paa Glasplader, belystes dels

i Brint, dels i atmosfærisk air.

Fremgangsmaaden var omtrent the same as ved de tilsvarende Forsøg med Bacteria, the vare indtørrede paa Bjærgkrystalplader. The reason for the Forsøgenes Langvarighed used is the større Lysstyrke and the distance between the Glaspladen and Kulspidserne. Lamps burned with 30 amps, 51-49 volts; temperatures af Vandet var 25o; The distance between the glass plates and the covers is 30 cm. i Stedet for the tidligere Forsogs 60 cm., hvorved altsaa Lysstyrken blev den firedobbelte. Glaspladerne vare de samme, som jeg benyttede til de Forsøg, dere omtalte i min Afhandling "Om ultraviolet Straalers baktericide Virkning" H. VII p. 56.

Forsøg No. 1. 25, 1901.

25/5 24/5 Kl. 10 Em. Opslemmes en 26 Timer gammel potato culture af Staf. pyog. aur. i distilled Vand. filter ring. - Draaber afsættes paa Glasplader. – Tørring i Thermostat ved 34° from Natten. Efterat Brintudviklingen had the first hold in the 1st time. The 1st hold for Belysningen was 1 time and 25 minutes, the 2nd hold was 30 minutes.

Kulturerne undersøgtes 27/5.

a. Belysning i Brint.

Efter 5 min. Belysn. gathered the colonists.

10

do. 2 det Hold 20

do. 30

do. 45

tætstaaende, utællelige, iso

lerede colonists. 1st Hold 1 Tim.

do. 14/2

19 colonists. control culture

gathered the colonists. Result: Bacterierne dræbtes ved 14/2 Times Belysning, men ikke ved 1 Times Belysning.

b. Belysning i atmosfærisk air.

Efter 2 min. Belysn. gathered the colonists.

4 Belyste pairs

do. Bettcher's nimble camera. 6

do. 9

do.

12

do. Belyste couple of brass blocks. Gen

15

next. collects. Col. sugning af atmos20

do. færisk air. 30

valley isolerede colonists. control culture

gathered the colonists. Result: bacteria dræbtes ikke whole ved 30 minutes Belysning

6

Forsøg No. 2. 15. 1901.

The applicable same Fremgangsmaade as ved det foregaaende Forsøg. Opslemningen lavedes forst same Formiddag

**

as forsøget udførtes. Draaberne paa Glaspladerne fordampede ved 2 Timers Stand i Thermostat. For Belysningen ledede s Brinthen over bacteria in 20 minutes; forud herfor havde Brintudviklingen været i Gang i 1'/Time. Ved de under b. nævnte Forsøg applied Gennemsugning af atmosfærisk air. Kulturerne undersøgtes 17/6 a. Belysning i Brint. Efter 1 Tim. Belysn. col

do. 2 det Hold 3/4

do. 1

do. tætstaaende, delvis sam

mensmeltede colonists 1st hold

tætstaaende, isolated Colon. 2

8 colonies. control culture

collected the colon. Result: bacteria dræbtes ved 2 timers, but not ved 11/2 times belysning.

1'12

b. Belysning i atmosfærisk air.

Efter 2 min. Belysn. gathered the colonists. 3dje Hold 4

do.

6 9 12

2 det Hold

do.

do. tætstaaende, next collecting colonists. 5 colonists.

15

20

2 Thurs. 30

11 Thurs. 1st hold 15

0 do. control culture

collected the colonists. Result: Bacteriernne dræbtes ved 15 Minutes, men ikke ved 12 Minutes Belysning.

Forsøg No. 3. 28. 1901.

The applied same Fremgangsmaade that ved de to foregaaende Forsøg Draaberne paa Glaspladerne fordampede ved Henstand en Nat over ved Stuetemperatur. Forud for Forsøget var Brintudviklingen i Gang i 1'/Time. Hvert hold brintedes i 30 minutes.

Culture undersøgtes 30/6.

a. Belysning i Brint.

Efter 1/4 Tim. Belysn. collected colon.

1

do.

do. 1

do.

11/2

tætstaaende, next samsmeltende colonists.

O colonists. 2

0 control culture

collected colon. Result: Bacterierne dræbtes ved 1'/, Times, men ikke ved 5/4 Times Belysning.

b. Belysning i atmosfærisk air. control culture

gathered the colonists. Efter 2 min. Belysn.

do.
4

do.
do.

do.
10

do. 12

do. 15

do. 20

tætstaaende colonists. 30

- 16 colonists. 45

4 do. 60

2 Thurs. Result: Bacteriernne dræbtes ved 30 Minutes, men ikke ved 20 Minutes Belysning.

This Forsøg for clear Coverensstemmelsen mellem Results of Forsøgsrækkerne No. I and II paa den one side and No. III paa den otheren Side. Det viser sig, at naar Lyset gaar own glass,

he the stor Forskel paa the bactericidal Virkning i Brint og the i atmosfærisk air.

I Brint tilintetgøres Bacterierne under de her benyttede Forhold ved omtrent 1'/. Times Belysning, i atmospheric air under ganske tilsvarende Forhold derimod allerede ved 15-30 Minuters Belysning. If it is used in disturbing fields in the UK and in the atmospheric air end of Forseg, before Lyset kungik own Bjærgkrystal; he derimod ikke nær saa stor som ved Forsøgene i Række II.

Man maa imidlertid days in amount, because of its Lyset ikke alene own glass, before the other ultraviolet rays are absorbed, men also own et Lag Agar, which are absorbed in Del af de øvrige kemiske Straaler.

In amount of all three Forsøgsrækker viser altsaa, at some more kemiske Straaler Lyset indeholder, the mere more dependent on Ilten bliver the bactericide Virkning. Hvis det indeholder alle de Straaler, der Kunne gaa igennem Bjærgkrystal (Forsøgsrække III), afhænger Bacterernes Modstandskraft kun i ringe degrees af, om de ere i Berøring med atmosfærisk Luft eller med Brint. Hvis Lyset beroves en Del af sine ultraviolet Straaler ved at gaa igennem Glas (Forsøgsrække VI), forringes Lysets bactericide Evne meget ved at the atmosfæriske air refunds af Brint. Eventually, if the Lyset is applied to the ultraviolet rays and also to the other chemical rays from the own bath glass and Lag Agar (Forsøgsrække II), the bactericidal virus is high in the degree that it is applied to Stede.

Som jeg andetsteds har forklaret nærmere, have glass and atmospheric risk air omtrent samme absorptionsevne overfor ultraviolet rays. Forholdene i Forsøgsrække No. VI (Belysning af Bacterier, indtørrede paa Glasplader) svare derfor omtrent til de Forhold, under hvilke Sollyset that comer til at paavirke Bacterier. The bactericidal virus is still active if the bacteria are in contact with the virus. Under visse omstændigheder – naar Sollyset gaar igennem et Medium, the absorber en Del af dets kemiske Straaler kommer det til at virke under samme Betingelser som det elektriske Lys i Forsøgsrækken Nr. II (Belysning af Bacterier paa Overfladen af Agar i et Reagensglas),

saa at dets bactericide Virkning bliver meget rings, hvis Bacterierne ikke velvetidig udsættes for Iltens Paavirkning.

The results of this study can be summarized in the following summary:

1) Lysets bactericidal Virkning he ikke in den Forstand en Iltningsproces, at Tilstedeværelsen af Ilter en Betingelse for den. Lyset can also have three bacteria, but it is also true that the spores on it are fjernet, and then there are those under Belysningen that cannot be broken down by chemical substances.

2) Naar Lyset contains the electricity Buelys's first ultraviolet rays, som kun gaa own Bjærgkrystal, man ikke own glass, he dets bactericide Virkning kun i ringe degrees afhængig af Tilstedeværelsen af Ilt.

3) That under 2) next gælder, hvad enten Bacterierne ere indtørrede eller de ere opslemmede distillet Vand eller de ligge paa Overfladen af en fugtig Agarplade.

4) For cells with bacterial resistance in Brint and in atmospheric air risk forøges, hvis Lyset beøves the most ultraviolet rays from gaa own glass.

5) For cells, there is a need, after a Lyset for the other ultraviolet rays and also for the other chemical rays given at the passere bathe Glas and Lag Agar.

6. Jo færre kemiske Straaler Lyset indeholder, the mere synes altsaa dets bactericide Virkning at afhænge af, om Bacterierne have Adgang til Ilt.

SKYLDES LYSETS BAKTERICIDE EVNE EN DIRECT VIRKNING PAA BAKTERIERNE ELLER EN INDIRECT PAAVIRKNING, VED UDVIKLING AF ET BAKTERICIDT STOF I NÆRING SUBSTRATE?*)

AF

VALDEMAR BIE

I amount to, at Lyset kan paavirke en Mængde kemiske Stoffer, ligger den Formodning nær, at det ogsaa kan fremkalde kemiske Processer i de sædvanlige Næringssubstrater, before the muligvis customer thenes Stoffer, some ere skadelige for bacteria. Allerede DOWNES og BLUNT der først af alle (i 1877) paaviste, at Lyset kan dræbe Bacterier, og undersøgte de nærmere Detailler ved then Proces ved in Række udmærkede Forsøg tænkte sig denne Mulighed, men de found, at deres Næringsvædska ber vedter ved Belysning. This is in the pastes pasteurs Vædske, and opløsning af Sukker, vinsur ammonia and other salts.

These Aars interesting Undersøgelser paa the Omraade have their starting point in the following Forsøg, which Roux udførte i 1887.

Kulturflasker med enten 1) sterile Kalvebouillon eller 2) Kalvebouillon, hvori der var saaet Sporer af Bac. anthracis, saturated for Sollyset velvety and side on side.

Bouillon layer var 5 mm. højt. Hver Time tog Roux en Flaske af Hver Slags ind. De, som heldt sterile broth, bleve tosaede med anthrax spores, before all flask cores stilledes in the thermostat. I Almindelighed dræbtes Sporerne i Række 2) ved 2 Timers Belysning. I de Flasker af Række 1), der ligeledes vare belyste i 2 timers, voksede de efter Belysningen saaede Sporer derimod som Regel ud. Men dersom the sterile broth belystes i 3 eller 4 timers, kunde de Sporer, der saaedes

*) Afhandlingen har været trykt tidligere som Del af min Doktorafhandling.

i the efter Belysningen, ikke vokse ud. The ware dog is not dræbte, is the same as the voksede, but you can say that it is over and there is not a lot of bouillon on the same slags. Som man saaede udvoksede Bacterier i broth, which var belyst saa længe, at Sporer ikke kunden udvikkle sig deri, voksede de yppigt. Den Forandring af Vædsken, som var stor nok til at forhindre Sporerne i at spire, skadede altsaa ikke Udviklingen af de udvoksede Bacterier.

Roux meddeler endvidere, at ved Belysningen affarves Bouillonen snart. Han mente, at begge these Forandringer skyldes en Iltning, fremkaldt af Lyset. At Ilten spiller en Rolle, paaviste han ved at belyse the same broth, tillsaaet med anthrax spores, ducks i et glass, high air flow havde Adgang (a) eller i et helfyldt glass, som var lukket for begge Ender (b). Efterat de ware belyste lige Længe, hældte han vædsken ib) over i et glass, high airflow has the adgang, and full begge glass in the thermostat. Sporerne af b) udviklede sig, selv i det Næringssubstrat, som var belyst sammen med dem, medens de ia) ikke voksede ud.

Naar Sporer saaedes i broth, the i flere timer havde staaet i Sollyset i lukket glass eller under Kulsyre, customer de ligeledes vokse. Derimod var det tilstrækkeligt at belyse den samme broth in nogle timer under Adgang for Luften, for at opnaa, at Sporer ikke kunden spire in den.

That var brighter ikke ligyldigt, hvilken Form Glasset havde; Lysets Virkning var strongest, to the størst mulige Vædskeoverflade var i Berøring med Luften,

Roux antog, at de Substanser, som oxyderes, ere Kulhydrater. DUCLAUX har nemlig paavist, at these Substanser meget let iltes i Sollyset. Roux mener derfor, at man kan gøre Bouillonen mere "antiseptic" ved Belysning, naar man tilsætter Stoffer, som let iltes i Lyset, f. Ex. Druesukker.

Roux has foreign paavist, at en belyst Næringsvædske, i hvilken Anthraxsporer ikke kunne spire, kan genvinde sine nærende Egenskaber, hvis man sætter den i diffust Lys eller Mørke.

De Sporer, som ikke spire i Termostaten in belyst broth, bevare its vitality length. The man for the over i ubelyst broth, spire de godt, even after 12 days Henstand i den belyste bouillon.

Roux's Forsøg ere grundlæggende for the Spørgsmaal, jeg her har busy mig med, og have været af stor Betydning for Opfattelsen af Lysets bactericide Virkning, idet de lede Tanken hen paa, om Lyset paavirker Bacteriernne direct or indirect, ved Frembringelsen af et baktericidet St Næringssubstratet. Roux found jo ganske vist, at en belyst Bouillon, hvori Sporer ikke kunde spire, ikke havde nogen skadelig Indflydelse paa udvoksede Bacteria. Men dette customer muligvis bero

at Sporernes Spiringsproces he mere følsom overfor vedcoming chemical substances and bacterial vegetative Processer. Hvis det he Tilfældet, maa these ogsaa kunne paavirkes, naar Belysningen foregaar under Forhold, before the skadelige Stof udvikles i større Mængde.

De Forskere, the i de following Aar undersøgte Lysets bactericide Virkning, confirmed the sig meget med denne Say, men have ikke brought before Viden derom meget fremad, idet Forsøgene have givent varying results, to Trods for, at Fremgangsmaaden har været omtrent ens.

DUCLAUX (1892) has paavist, at ved Belysning af Raulins Vædske then the Myresyre af Vinsyren, before Væksten af forskellige Skimmel. svampe forsinkes.

Kun en enkelt Forsker MARSHALL WARD (1893) har ligesom Roux undersøgt Anthraxsporernes Forhold; i Modsætning til Roux found han, at this spire ligesaa godt paa belyst Agar som paa ikke belyst.

Prouden dette Forsøg, the var en Efterligning af Roux's, udførte Marshall Ward the following: Miltbrandsporer indtørredes paa Bunden af Petris scales, which derefter stilledes i Sollyset together with other scales, i used the var sterile agar. All scales are dakkede with a zinc plate, if the variable is udhugget and cors eller lignende. After that, the instructions for use with Sporer and Agar, and the sterile Agar for Sporer. Forsøget ordnedes halledes, for which hvis Lyset ikke havde nogen direct Indvirkning paa Bacterierne, maatte de indtørrede Sporers Vækst blive ligesaa kraftig ud for the

udhuggede Figure i Zinkpladen, som hvor de havde ligget i Skygge; de Sporer, the bleve saaede paa den i steril Tilstand belyste Agarplade, maatte derimod vokse mindre kraftigt paa den belyste Del af denne; hvis Lyset paavirkede baade Sporerne og Agarpladen, vilde Figurerne træde frem i begge Slags Kulturer.

Results blev, at the ikke customer iagttages nogen tydelig Virkning paa Agaren; Bacterierne voksede ligesaa strengthens paa the best Del af Pladen som paa den Del, der havde været i Skygge; the indtørrede Sporer dræbtes derimod ved Belysning i et lignende Tidsrum.

Det kunden tænkes, at Marshall Ward var til et andet Result end Roux, fordi han havde brugt Agar i Stedet for Bouillon; Men herimod taler CHMELEWSKY's (1892) Paavisning af, at baade Gelatine og Agar blive at least brugbare som Næringssubstrat for de pyogene Coccer ved Belysning, medens Bouillon slet ikke forandredes ved hans Forsøg. Fremdeleles have en Del af de i the following nævnte Forfattere fundet Forandring af gelatine, andre af bouillon.

After all, the results are the same for the suspected organisms, it is the same as for the fore, where there are more and more with the same type of bacteria. The træffer sig saa held, at B. tyfosus har været used on the following fire Forskere.

JANOWSKI (1890) udsatte Bouillon, hvori der saaet Tyfus. baciller, saa length for Lyset, til den var sterile. Then han nu stillede den i Morke og atter saaede Tyfusbaciller i den, blev den snart uklar. Janowski slutter heraf, at Sollyset har paavirket Tyfusbacillerne direct,

var

and at Forandringerne in Bouillonen ikke ere saa betydelige, at Bacteriernne derved kunne dræbes eller blot hindres i deres Udvikling.

GEISLER (1892) reported a) Tyfusbaciller paa Overfladen af gelatine and b) sterile gelatine; derefter saaede han Tyfusbaciller paa denne together paa c) Gelatine, der havde staaet i Mørke. De Bacterier, som havde været udsatte for Lyset (a) voksede daarligst; de, the vare saaede paa the belyste, sterile gelatine (b) voksede bedre, og control cultures (c) bedst. Geisler found altsaa, at Gelatine bliver notre brugbar som Næringssubstrat ved at udsættes for Lyset.

BUCHNER (1893), the undersøgte flere Arter foruden Tyfusbacilli, mente derimod, at the svagere Vækst i de belyste Dele af hans Pladekulturer ikke kunden bero paa en Forandring af Næringssubstratet (gelatine and agar). Have used sterile agar plates, melted derefert agars and used the sprednings culturer. These are listed together with Spredningskulturer in Agar, so that they do not have to be used for Lyset. Because the bacteria are still alive, it is not known that the Forskel paa disse to Rækker Kulturer.

BILLINGS and PEEKHAM (1896) found, at i Bouillon, som havde været udsat for Sollyset i 1-10 Dage og derefter var tilsaaet med Tyfusbaciller, voksede disse kun sparsomt; i Bouillon, som var belyst i 50—60 days, customer de slet ikke vokse. Agarplader gave the same result.

DIEUDONNÉ (1894) has to do with the first Forsøg Fremgangsmaade som Flertallet af ovennævnte Forskere: Belysning af Næringssubstratet (Agar og gelatine) with Sollys, og derefter Tilsaaning af the belyste Plader og af Kontrolplader med Bac. fluorescence, Micr. prodigiosus and Bact. coli. The iagttoges let inen Forskel, ikke engang i Pigmentdannelsen, som dog yderst let paavirkes af Forandringer i Næringssubstratet.

Ved et sere Forsøg har Dieudonné bragt os Løsningen af Spørgsmaalet nærmere ved Hjælp af en udmærket udtænkt Fremgangsmaade. For at kunne paavise selv en ubetydelig Forringelse af Agarens Brugbarhed som Næringssubstrat benyttede han ikke, som de hidtil n æ vnte Forskere, Bacterier fra en kraftig Kultur, men prøvede, om Bacterier, hvis Vitalitet var svækket ved Belysning, voksede dene selringerde substrate , couple of bottles of belyste, end up being overførtes to frisk broth. Han klistrede et sort Kors paa Unterfladen on Agarkulturerne, og must derefter disse for Sollyset i 3/4, 1, 11/4 og 14/2 Time. Derefter scar han smaa Stykker ud af den belyste Del af Agaren og lagde dem i Bouillon. After 24 timers Forløb havde den Del af Pladekulturerne, which havde været dækket af Papirkorset, udviklet sig fuldstændigt. For the indicated Del af Pladekulturerne together with Bouillonkulturerne var the following results:

together

agar plates

Belysning i 14/, Time 1/4 Time

1 time and 3/4 time

Ingen Vaekst. Ingen Vaekst.

Ingen Vækster 24 timers

Forleb, men Vækst efter 48

Timer's Forleb.

broths

Ingen Vaekst. Ingen Vækst efter 24 Plumret efter 24 Timers Forleb.

Timer's Forlab; plum

ret after 48 timers

Forlob.

De ved Belysning svækkede Bacterier udviklede sig altsaa bedre i frisk Næringssubstrat end i det, hvori de vare belyste. Denne Forandring af Næringssubstratet he dog saa ringe, at the efter Dieudonné's Mening træder i Baggrunden ligeoverfor Lysets direct Indvirkning paa Bacteriernes protoplasm.

The Forsøg he saa meget the more interesting, som man maa vente at kunne opnaa the same result ogsaa med Bacterier, hvis Vitalitet he usvækket, naar man blot forstærker Lyset.

FRANKLAND (1893) gør opmærksom paa, at adskillige af de tidligere Forskere have fundet, at Bacterierne modstaa Lyset bedre, naar de ere opslemmede i Vand, end naar de ere opslemmede i et Næringssubstrat. For at reason hertil har han undersøgt, om bacteriernes Modstandskraft for andres ved, at the tilsættes Klornatrium eller svovlsurt Natron til the distilled Vand, hvori de ere opslemmede. This shows you, at Lysets bactericide Virkning var adskilligt større overfor Bacterierne in Na Cl-

Opløsningen end overfor dem i distilled Vand; Tilsætning af Na, S04 i samme Forhold havde derimod ingen eller kun en ringe Indflydelse.

No subsequent result have all these undersøgelser ikke brought. Overfor de Forsøg, who have given positive results, staa Forsøg med negative Results, udførte af ligesaa paalidelige Forskere og paa omtrent samme Maade som de others. Forst da RICHARDSON i 1893 paaviste, at the udvikles Brintoverilte ved Belysning af Urin, og hævdede, at the sandy synligvis he dette Stof, ikke Lyset selv, der dræber Bacterierne, kom der mere Sikkerhed over these Undersøgelser. Fra nu af maatte Udredningen af Brintoveriltets forhold to Lysets bactericide Virkning naturligt blive Forskernes væsentligste Opgave.

RICHARDSON fremsatte the following testers: 1) The then Brintoverilte, naar frisk urine udsættes for Sollys og Ilt2) Brintofilte holder sig længe i sterile urine, men dekomponeres hastigt,

to the living organism to Stede. 3) Microberne destructs selv ved decompositions af Brintoveriltet. 4) Frisk urine for antiseptic Egenskaber, on the udsættes for Lyset. 5) Den under 4) nævnte antiseptic Virkning ber paa Tilstedeværelsen

af the Brintoverilte, which he then in Urinen ved Belysningen. 6) Lysets sterilization of urine skyldes in stor Udstrækning,

om ikke udelukkende, Virkningen af Brintoverilte paa Mikroberne.

DIEUDONNÉ (1894) continued with Richardson's Forsøg ved at undersoge Gelatines og Agars Forhold. There are the following results: 1) Brintoverilte-Dannelsen he indskrænket til the belyste Dele af Pladen. 2) Brintooverilte then kun ved de aktiniske Straalers Indflydelse. 3) Brintoverilte dekomponeres let i Mørke. 4) Brintoverilte can then, after which it is sent to Stede. 5) Bacteria and their spores can also be vanskeligt, or maaske slet

None, tiled gøres, to the ingen Ilt he til Stede.

If 4) and 5) men Dieudonné at kunne slutte, at Dannelsen af Brintoverilte ved Luftens and Lysets Indvirkning synes folgelig at være af ikke uvæsentlig Betydning for Lysets bactericide Evne.

Ogsaa Kruse (1895) has employed sig med Brintoveriltets Betydning for Lysets bactericidal Virkning. In Modsætning to Richardson and Dieudonné frakender there is another Indflydelse paa then.

Kruse paaviste, at Bacteriumsporer tilintetgøres fastere af Lyset, when it is opslemmede in Bouillon, end when it is opslemmede in the distilled Vand; Derimod gør det ingen Forskel, om Bouillonen fortyndes i Forholdet 1:20. For bacteria and spores are known, the rule is stated in the test in the same retrieval, and there are other things that need to be done for spores. That is what happens, at Forandringen in Næringssubstratet he en væsentlig Factor ved Lysets bactericide Virkning, i hvert overfor Sporer, i hvor vel det he paafaldende, at stærk Fortynding af Bouillonen ingen Indflydelse har. From this Forsøg see the sign, at the Lysets Indvirkning paa Bouillon and Peptonopløsning then the et antiseptic substance on these complicered Kvælstofforbinderelser; derimod bleve Opløsninger af Sukker og vinsur ammonia ikke antiseptics.

Kruse confirmed, at the then Brintoverilte ved Belysning af Vand og de sædvanlige Næringssubstrater; han tror dog ikke, at the oven for omtalte bactericidal substances he Brintoverilte, sordi det thenes lettere i Bouillon end i Vand, medens Brintoverilte then lettest i Vand.

Kruse found, at bacteria dræbtes ved nogle faa Timers Belysning; Selv Bouillon, the last antager antiseptic Egenskaber, mat han derimod udsætte for Sollyset i flere Dage, hvis han vilde opnaa, at Bacterier, som saaedes deri efter Belysningen, blot hæmmedes i Væksten. En Bouillon, som efter at være tillsaaet med Tyfusbaciller steriliseredes ved tre Timers Udsættelse for Sollyset, var et brugbart Næringsmedium, since the couple saaedes den samme Mængde Tyfusbaciller deri.

Eftersom der Altsaa behøves meget longer Belysning for giving broth antiseptic Egenskaber end for at dræbe Bacterier i den samme broth, kan Lysets bactericide Virkning i hvert Fald ikke udelukkende skyldes Udviklingen af antiseptic substances in Næringssubstratet; "vi altsaa antage, at Lyset ikke alene frembringer en Forandring af Mediet, men ogsaa virker umiddelbart paa Bacterierne."

maa

On all these undersøgelser you can with no rings Sandsynlighed slutte, at the southern vanlige Næringssubstrater faa antiseptic Egenskaber ved Belysning; noget sikkert véd man dog ikke herom, eftersom Forsøgene have givent uoverensstemmende results. Den Opgave, the forelaa for mig, var altsaa at fastslaa, om denne Formodning er rigtig, og i saa Fald at opklare, om Lysets Evne til at dræbe Bacteria he afhængig af eller i hvert Fald forøges ved Udviklingen af et antiseptic Stof.

Som say staar for Øjeblikket ligger det nærmest at undersøge, om the udvikles Brintoverilte ved Belysning af the forskellige Næringssubstrater, og i saa Fald, om the material bidrager til Bacteriernes Tilgrundegaaen.

The other forests have been too high towards the slut, at the point of the udvikles and bactericidal substances in the vicinity of the næringssubstraterne, maa Lysets bactericidal Evne i hvert fald til Dels bero herpaa; then it isn't available, it isn't given, at the coming substances in the same area as before, there are bacteria, and there are many growths for a long time Tids Belysning for at udvikles, at Bacteria for the longest dræbte, when the sight is sig det first spor on det. The foreligger follows to skarpt adskilte Spørgsmaal: I. a. Then the et bactericidal substance from Belysning af de

sterile Næringssubstrater? b. I say Fald: is this the material? II. a. Bestaar Lysets bactericidal Evne i en direct Ind

Virkning paa Bacterierne else i en indirect Virkning, ved Udvikling af et baktericidt Stof i Nærings substratet, eller i en Samvirken af begge

factorer? b. Hvis Udviklingen af et baktericidt Stof har nogen

Betydning, does he have that fabric? He's the same

som det under I b. omtale?

If it is necessary to talk about this forhold, it is possible to see, then, in Modsætning til the tidligere Forskere, arbejder med constant Lys, saa at man can sammenligne in long Række Forsøg og konstater, before long forskellige Næringssubstrater maa belyses, in den Septis faa antiseptic Egenskaber, og inden the udvikles Brintoverilte in dem, together with before accelerated bacteria dræbes in forskellige Næringssubstrater. At any time you can work with constant and constant strength Lys he therefore in stor Fordel.

I. Then the et bactericidal substance from Belysning af

Næringssubstraterne?

A. Forsøg med Miltbrandsporer.

De Forsøg, hvorved Roux viste, at Miltbrandsporer ikke kunne spire i Bouillon, som he belyst tilstrækkelig Længe, ere saa overbevisende, at deres Paalidelighed næppe kan af kræftes ved, at Marshall Ward ikke kunden paavise en tilsvarende Forandring at Agar. That he muligt, at Næringssubstratet he Aarsag hertil, men sandsynligere he det dog, at the forskellige result ber or paa Forskellen i Lysstyrke. Ward adførte nemlig sine Forsøg i Slutningen af January and the first day af February, Roux derimod sine i July.

For dog at overbevise mig om, at det he Roux, der har Ret, har jeg gjort et par Forsøg med Miltbrandsporer, omtrent paa samme Maade som Roux's, inden jeg founded paa Hovedforsøgene, som udelukkende ere udførte med udvoksede bacteria.

Forsøg No. 1. 15/1898.

Paa 10 smaa Flasker med kvadratisk Tværsnit fyldes Kalvebouillon, 2 cm. i hver. The 5 functions are as control flares and lengths in Mørke, and the other 5 lengths vandret in Solskinnet paa hvidt

paper. Hver Time day of the en ind, og i the og en Mørkeflaske saas the en Øsken Anthraxsporer, fremstillede ved at opvarme en 28 Day gammel Bouillonkultur till 70° i 10 Min. Vogel's photometer, udsat for Lyset i 1 minute, visit Kl. 11 Fm. No. 12, K1. 21/8 Em. No. 10.

Forsøg no. 2. 167, 1898 cl. 11 fm.

10 square culture flasks with 2 cm. Kalvebouillon i hver lægges i Solen paa hvidt Papir. Hver Time tags 2 ind og tilsaas with anthrax spores. These were previously stilled at skrabe af en 3 Maaneder gammel agar overflade culture, opslemme i distilled

177, cl. 8 fm. plum-plum- clear clear clear clear | clear clear clear

plumret

Vand, filter against hygroscopic Vat and warm up to 70° i 10 minutes. Under Forsøget stod Reagensglasset med Sporeopslemningen paa Is. Efter Forsøgets Slutning customer microscope paavises mange Sporer men ingen Stave. The saaedes 1 Øsken i hver Flaske. Samtidig med de 2 belyste Flasker tilsaaedes 2 control Flasker.

This to Forsøg have given the same result as Roux's: the longer broths belyses, the smaller the sporerne ad, and the belyses the tilstrækkeligt length, you can de little ikke vokse i den.

Roux har set Sporerne ligge i Dvale i indtil 12 Day, uden at kunne spire, men ogsaa uden at være dræbte. Nogen særlig interest har det vel ikke at fastslaa det Tidspunkt, da Sporerne gaa til Grunde, men je har dog i sidstnævnte Forsøg efter 12 Days Forløb (28/) saaet over i frisk Bouillon fra de Flasker, hvori Sporerne ikke vare voksede ud. You see sig, at Sporerne vare gaaede til Grunde paa dette Tidspunkt.

Because you have an electric Lys to all of your Forsøg med advoksede bacteria, you have for Sammenligningens Skyld ogsaa saaet Miltbrandsporer in Bouillon, som var belyst paa denne Maade, under ganske samme Forhold som ved de senere Forsøg; Other broths were the same, as used to these.

Forsøg No. 3. 4. 1900 Kl. 1-24/2 Em.

Bouillondraaber, anbragte paa Bunden af Bjærgkrystalskaalene, belystes med 35 Amp., 51-49 Volt; Concentration apparatus distance from the middle of the crater var 11°, cm., Bjærgkrystalskaalens distance from the apparatus 132 mm. Efter Afslutningen af Belysningen saaedes the med Spidsen af en Podenaal Miltbrandsporer i the belyste Draaber og i en Kontroldraabe, hvorefter Bjærgkrystalskaalene anbragtes med Bunden i Vejret paa fugigt Filterpapir i Petris Skaale, som stilledes i Termostat. Sporerne vare fremstillede ved at skrabe noget af en 96 Day gammel Overfladekultur af B. anthracis, opslemme det i 1 cm. Bouillon and warmed up to 71-69° in 10 minutes. Microscopes: Masser af Sporer, slet ingen Stave.

Forsøg No. 4. 5/5 1900.

Fremgangsmaaden var som ved forrige Forsøg, med Undtagelse af, at Sporeopslemningen fortyndedes ved at føre en lille Øsken af den over i 2 cm.bouillon; herfra saaedes med Spidsen af en fladhamret Podenaal.

Ogsaa ved Belysningen med elektrisk Lys then the old saa et skadeligt fabric in bouillons, som bevirker, at jo longer Belysningen har varet, the more spire Sporerne.

B. Forsøg med udvoksede bacteria. At the ved Belysning af Bouillon then et for bacteria skadeligt Stof synes which ikke at kunne være nogen Tvivl om, efter the sammmende Result af Roux's og mine Forsøg. Spørgsmaalet er da: af hvad Natur er dette Sto? After the Retning, the Undersøgelserne paa dette Omraade have days in their Aar (Richardson, Dieudonné, Kruse) ligger det nær først og Fremmest at Undersøge, om det he Brintoverilte.

For come to clear herover har jeg undersøgt, hvilke Betingelser dels the bactericidal substance, the Brintoveriltet kræver for at udvikles i forskellige Næringssubstrater.

a. Under hvilke Betingelser then Brintoverilte ved Belysning

af Vædsker?

Until Paavisning af Brintoverilte har jeg used Schönbein's reaction, som je har udført paa the following Maade: To den belyste Draabe Vædske satte jeg 1) med en lille Platinøsken noget tyndt Hvedestivelseklister, som var filtreret gennem hygrooskopisk Vat, 2) med samme aføen noget 10% Jodkaliumopløsning, 3) with Spidsen af en Fladhamret, lige Platinnaal lidt af and 2% Opløsning af svovlsurt Jærnforilte. Reagentserne vare hver Gang frisk tilberedte. Reactions above, at Brintoveriltet spalter iodine potassium, saaledes at the udskilles frit iodine, som farver Stivelsen blaa. Det svovlsure Jærnforilte tjener til at indlede reactions. Paa dane Maade customer each paavise Brintoverilte in en 0.00016% Opløsning in distilled Vand (omtrent 1:600,000); i Bouillon gav først en omtrent doublet saa strong Opløsning reaction. Under Tilsætningen af svovlsurt Jærnforilte holdt jeg Bjærgkrystalpladen nogle Tommer over et Stykke hvidt Papir, for lettere at se Blaafarvningen.

Brintoverilte-Reactionerne, the ere udførte igennem et længere Tidsrum, have samme Værdi, som om de vare udførte sametidigt, eftersom jeg har arbejdet med constant Lys; Because the guarantee for Opnaaelsen af constant results has every yderligere øget, idet jeg omtrent hver Gang jeg har udført Forsøg af den Art, har prøvet, hvor length every maatte belyse en 1% Peptonopløsning

(Pepton Witte, stadig taget af samme Daase) for at faa Brintoveriltereflex, og stated, at that time Tid altid var den samme. Desuden har jeg til Slut prøvet med omtrent all Vædskerne i umiddelbar Rækkefølge.

The following oversight tables have different results from mine Forsøg. Hvert Tegn betegner Results af et Forsøg; ? betyder, at jeg ikke bestt har kunnet afgøre, om reactions var til Stede eller ej, enten fordi den er forsvundet meget hastigt, eller fordi har holdt Bjærgkrystalpalladen in en uheldig Stilling til Lyset i det øjeblik, jeg tilsatte Opløsningen af svovlsurt Jærnforilte.

You have firstly underestimated, of Tiltedeværelsen af certain chemical substances he needs for later af Brintoverilte, and later, om forskellige fysiske Forhold have nogen Indflydelse herpaa.

Under Udførelsen af all these Forsøg have distance between the Kulspidsen and Koncentrationsapparatet is 114/2 cm.

In the following table he results after hvert enkelt Forsøg gengivet. P. 75 finds a table, i hvilken jeg har sammendraget Hovedresultaterne af Forsøgsrækkerne.

I. Bouillon. 1 Ī Kalvekød to 1 liter Vand; Tilsætning af 1% peptone, . % Na Cl og Na OH til svagt alkaline reaction. Each has the same broth to these Forsøg and to the p. 86 or fig. beskrevne Forsøg med bacteria.

II. Kødafkog (1 ã Kalvekød til 1 liter Vand) med "

%% 1 s Na Cl, uden peptone, svagt alkaline.

1015 1615

1/2

IV. 1% Peptonopløsning med Tilsætning af mælkesurt Natron (stillet ved at neutralisere en 75% Opløsning af Mælkesyre med en 20% Opløsning af Na OH; 1 cm. comes up to contain approx. 0.35 grams of mælkesurt natron).

*) Formulas for Uschinsky's Vædske.

van

Grams 1000

Maelkesur Ammonia

10

asparagine .

3.4 glycerin..

40 sodium chloride.

5 magnesium sulfate.

0.2 calcium chloride

0.1 potassium biphosphate.

1.0

Som follow af en fejl Formel i Flügge's textbook of bacteriology has jeg brugt asparagine i Stedet for asparaginsurt Natron, Jeg ha gjort Vædsken svagt alkalisk med Na OH og filtreret gennem Chamberlands filter, since the kom Bundfald ved steam sterilization, vistnok ved spaltning af ammonia salts.

Reaction time ere ikke fuldt ud constant. For a Del kan det skyldes, at jeg ikke altid har kunnet tillsætte Reagenserne in nøjagtig samme Mængde. In the case of reactions, there is a reason for the tidligere Maade - see the first brugelige til with Formaal - afhænger den tilsatte Mængde noget af, before the Podenaalen dyppes, and in the hvad stilling den holdes. Hovedaarsage to Variationerne maa dog sikkert soges i, at reactions he udført i verkslende Belysning. In the Farve reaction, it should help altid gøres ved samme Belysning, særlig naar, som i dette Tilfælde, Farven kun held sig ganske kort (the svageste Blaafarvning held sig kun i ca. 1 second). However, you have tested the other reactions in the Mørkekammeret ved Glodelampebelysning, but when there is a svag Blaafarvning customer, you do not recognize it under this Forhold. Anything that needs to be done at Bruge Dagslys; paa mørke Winterdage har jeg dog refunded this with elektrisk Buelys.

Ved Schönbein's iodine potassium-Stivelse reaction paavises foruden Brintoverilte ogsaa ozone. However, there is a risk that there are really flammable fuels, no ozone, then there will be Belysningen, including reactions that there will be no fremkom ved, at Vædsken there will be optaget ozone in the surrounding air; If the electricity jumps in the Buelampes electrodes, the corresponding ozone should be there.

Begge this Muligheder kunne udelukkes alene paa reason af, at a Del af de nævnte Vædsker kunne belyses i long Tid (10—60 Minutes) uden at give reaction. For the best results, you can see all of them, at the top of the list of materials you can tell for hindre reactions Fremkomst; Then I can't think of a case where I don't have a gælde for the distilled Vand, so that I have more than 60 minutes, and then at the end of the Brintooverilte.

Imod den Opfattelse, at the three sig om absorption of ozone from the omgivende air, taler desuden den Kendsgerning, som je skal skal employ mig med, nemlig at den Tid, i hvilken en Vædske maa belyses for at give reaction, he omtrent proportional med Lysstrken.

For dog at være ganske sikker har jeg 29/10 1899 belyst en Draabe 1% Peptonopløsning paa sædvanlig Maade i 15 Minuter, og derefter tested med et Reagens, given Ozone paavises, selv om den Finds sammen med Brintoverilte og Saltpetersyrling. The coming reaction. In Draabe af the samme Peptonopløsning gav derimod tydelig reaction with Stivelse, iodine potassium and svovlsurt Jærnforilte after 3 minutes Belysning under samme Forhold. The complete ozone reagent was available in a fresh alkaline solution based on metaphenylenediamine hydrochloride (0.1 gram of salt in 90 cm. and 10 cm.: 5% sodium hydroxide content). 25 cm. After Opløsning farves burgundyrød after 0.08 milligrams of ozone i Løbet after 5 seconds.

For at se, om the overhovedet finds saa meget ozone in air omkring lamps, at which kan have Indflydelse paa Forsøgene, har jeg suget Luft fra et Sted i Nærheden af Lamps Had their own Oplosning. Under Forsøget holdt each Værelsets Døre og Ventiler lukkede, for at faa Luften omkring lamps until at staa saa roligt som muligt.

20/10 1899. Generating about 5 liters of air in Løbet af 5/4 Time. Spidsen af the tilførende Rør var i Højde med Lampehættens Underkant, about 5 Tommer derfra.

Ingen ozone reaction.

%u: Gennemsugning af approx. 5 liters of air in Løbet af 68 Minutes, fra omtrent samme Sted som i foregaaende Forsøg.

Ingen ozone reaction.

For that reason, that there is no reagent set, som var Skyld i, at the no customer paavises ozone, har jeg to the following to Forsøg used the same reagent, so that I used to Brintoverilteprøverne.

1) 21/u. Taking air, take 1% Peptonoløsning in a test tube, as long as it is in a cylinder (in a blink cylinder). Spidsen af the tilførende Rør var paa det Sted, before Bjærgkrystalskaalen plejede at staa. Lamps burned with 35 Ampère Stromstyrke. Døre and Ventiler holdtes luck.

Result: Ingen reaction med Stivelse, iodine potassium og svovlsurt Jærnforilte; After Tilsætning af lidt Brintoverilteopløsning blev Vædsken mørkeblaa.

betegner Draaben.

2) 21/1. Jeg skar et Hul in Bunden afen Papæske, requested a Bjærgkrystalskaal med a Draabe 1% Peptonopløsning over Hullet, full Laaget paa Æsken og skød denne ind i en Anden, større Æske uden Laag. Æskerne vare sværtede sort individually. Draaben var altsaa udsat for Luftens Paavirkning, men skyttet mod Lysets. Vedfejede Tegning giver en Forestilling om Fremgangsmaaden. Æskerne requested room, at Skaalen stod paa samme Sted som ellers. The current in 10 minutes (and longer Forsøg for hindredes ved, at Draaben tørrede ind), with lamps burned with 35 Ampère Stromstyrke. The foreign ozone reaction from Tilsætning af Stivelse, iodine potassium and svovlsurt Jærnforilte paa den sædvanlige Maade.

After this control, you can always do it with the best thing you can do with the substance, but only with Schönbein's reagents, with Brintoverilte, so that you have Belysning at Vædsken.

On the following table ser man, at Brintoveriltedannelsen afhænger af more Omstændigheder. 1) Den belyste Vædskes kemiske Sammensætning, 2) dens degree of concentration, 3) Lysstyrken.

I. Den belyste Vædskes kemiske Sammensætning.

Dennes Indflydelse paa Dannelsen af Brintoverilte fremgaar tydeligt af the following Oversigtsliste, hvor jeg har samlet Hovedresultaterne af the iblandt de beskrevne Forsøgsrækker, dere udførte med en Strømstyrke af 35 Ampère.

After these 12 Vædskere de fire first (1% Peptonopløsning, urine, Kødafkog uden Pepton og Bouillon med Pepton) de neste, before the then Brintoverilte ved Belysning, together with the enest, som independe full organke Kvælstofforbinderelser. Since the ikke then Brintoverilte i distilled Vand, selv ved 1 Times Belysning med et saa overordentlig Lys som det, jeg har brugt, maa Brintoveriltet stem from these Vædskers opløste Stoffer. At the Brintoverilte, the then in the Bouillon, I didn't stem from Pepton alene, so if, at that other can then in Kødafkog, that I didn't hold Pepton. Tilstedeværelsen af sammensatte Kvælstofforbindelser synes altsaa at være en Betingelse for Dannelsen af Brintoverilte. It cannot be reimbursed for ammonia salt. I Uschinskys Vædske, the jo indeholder 1% mælkesur ammonia, udvikles ingen Brintoverilte ved Belysning; that customer dog bero paa, at en af de other stock dele for hindrede reactions Fremkomst. For at overbevise mig om, which ikke ergrunden, har jeg beenlyst Opløsninger af et organic ammonia salt (chlorammonium) and af et organic (oxalic ammonia). Brighter ingen on the then Brint

(overilte.

I Hesteserum, the jo dog indeholder mange sammensatte Kvælstofforbinderelser, then the desuagtet ikke Brintoverilte ved Belysning. Jeg tror at have funded reasons hertil ved det under IV. S. 70 omtalte Forsøg, hvorved det viste sig, at medens man kan paavise Brintoverilte in 1% Peptonopløsning efter 24/7 Minuts Belysning, forhindrer Tilsætning af mælkesurt Natron reaction Fremkomst, selv om man belyser i 1 time under the same forhold, aabenbart fordi the substance virker reducerende. I Analogi hermed tør man vel antage, at the reducing substances in the serum, som for hindre Dannelsen af Brintoverilte.

The skyldes sandsynligvis ogsaa et ringe Indhold af mælkesurt Natron, at Brintoveriltet then these senere i Pepton-Bouillonen end i et Kødaf kog uden Pepton, til Trods for, at Peptonet jo netop skulde favorable dets Dannelse.

Heller ikke i Opløsninger af Rørsukker eller Druesukker then the Brintoverilte. The customer tænkes, at that time, men at the reducers straight away at which he opstates. For at faa at vide om that he Tilfældet har jeg undersøgt, om Druesukker forhindrer reactions Fremkomst, naar det sættes til en Opløsning, i vilken der then Brintoverilte ved Belysning; he didn't say Tilfældet. Forsøget var the following: 20/10 1899 blandede each lige Dele afen 1% Peptonopløsning and en 1% Druesukkeropløsning, og belyste en Draabe deraf med 35 Ampère. The comedic reaction ved 3 Minutes Belysning men ingen ved 2 Minutes (see under VIII. p. 71). Umiddelbart derefter, og under samme Forhold, belyste any Draabe af a 12% Peptonopløsning in ?

0

minutes; brighter ikke her customer of paavises Brintoverilte; The first reason for reactions is that there are no higher than Tilsætning af Druesukker.

II. Opløsningens Styrke. Dennes Betydning for Udviklingen af Brintoverilte ses af III, Forsøgene 16/5 p. 69. De vise, at under samme forhold shall be 1/2% Peptonopløsning belyses longer end en 1% for at give Brintoverilte reaction.

III. Lysstyrkens Betydning ses af the following Oversigttabel, the given result af Forsøgsrækkerne No. I and III, Forsøgene med Bouillon og Peptonopløsning.

a. Bouillon.

amperage.

Brintoverilte reaction esier Belysning i 10 min 8 min 4 min 34/2 min 3 min

he

The Tid, if you have a belyse and substance for at frembringe Brintoverilteaktion, oldsaa omtrent proportionally with Stromstyrken, og ogsa a med Lysstyrken; this term is also proportional. For the first work, the most powerful Lys is used for the most demanding applications, the customer uses the apparatus that is used, it has 35 amps, still the 114/2 cm concentration apparatus. fra the positive Kuls Spids, og anbrigt the Draabe, jeg belyste, ganske nær ved Koncentrationsapparatets fire point.

Foruden af den Belyste Vædskes kemiske Sammensætning, dens Koncentration og Lysstyrken, afhænger Udviklingen af Brintoverilte desuden af, om der Ilt til Stede, including af Lysets Kvalitet.

IV. Tilstedeværelsen or Manglen af Ilt. The following forsøg have been stated, at Ilt more advantageous then later on Brintoverilte, yes vistnok endogsaa he nødvendig for that, says that Richardson and Dieudonné have paastaaet.

Each attached small test tube with a par cm.1 % Peptonopløsning in a distance of 12 cm. fra the yderst lens, and vinkelret paa Lysstraalerne. The praise is kept from not over Glasset for at least Opvarmning af Vædsken. I 3 Forsøg lod jeg den atmosfæriske Luft boble igennem Vædsken, i et 4de ledede jeg Brint igennem; Denne var renset for Ilt ved at passere en alkalisk Pyrogallolopløsning. Efter Belysningen proposed any other Draaber af Vædsken paa en Glasplade and large Brintoverilteaktion in the paa den sædvanlige Maade. Results are the following:

8th

a. Generation of atmosfærisk air. 8/12 1899 65 Minuters Belysning. Strong reaction. 60

do. 60

do.

7

7112

8/12

b. Gennemledning af Brint.

8/12 1899 3 timers Belysning. Ingen reaction.

V. Lyset's Quality. Dieudonné har paavist, at Brintoverilte udelukkende then under Indvirkning af de aktiniske Straaler. That stemmer with hvad man paa Forhaand antage maa, da Lysets Virkning paa kemiske Stoffer ju hovedsagelig he knyttet til these Straaler. Each has been confirmed by the following forsog:

Each one has a Draabe 1% Peptonopløsning paa the southern Maade, men indskød paa and best Sted in Lyskeglen snart et mørkeblaat, snart et orange colored glass. The longer the violet light and the street passere next to usvækkede, they are absorbed by the old one in the other parts of the spectrum. The orange-colored glass was acceptable for the rod and the gule of the road, together with the location of the glass on the green. Stromstyrken var 35 Ampère, Koncentrationsapparatets Afstand fra det positive Kuls Spids 11"/2 cm.

Results are the following:

2

The ultraviolet Straalers Indflydelse paa Dannelsen af Brintoverilte he finally aldrig undersøgt; de bacteriologist, the tidligere have employed sig med Lysets Indflydelse paa bacterium, have overhovedet kun skænket disse Straaler meget ringe Opmærksomhed. Eftersom de ultraviolet Straalere i Besiddelse af en kraftig baktericid Virkning, he Spørgsmaalet om theirs Indflydelse paa Brintoveriltedannelsen af stor Betydning for Afgørelsen af, om Richardson og Dieudonné have Ret i deres Paastand, at Lysets bactericide Evne udelukkende, eller for a Del., Udviklingen af Brintoverilte in den Vædske, hvori Bacterierne ere opslemmede. Each has therefore undersøgt the Forhold. Min Fremgangsmaade var den samme ved det foregaaende Forsøg: Jeg belyste en Draabe 1% Peptonopløsning paa sædvanlig Maade, kun indskød jeg snart en Glasplade (1.4 mm. tyk), snart en Bjærgkrystalplade (1.7 mm. tyk) paa et bested Sted i Lyskeglen, 93 mm. for the first lens. Lysstyrken var 35 Ampère, Apparatets Afstand fra det positive Kuls Spids 11/2 cm. Forsøgene bleve udførte umiddelbart efter hverandre, first nogle Forsøg with Glasplade, derefter dem with Bjærgkrystalplade, to Slut atter nogle with Glasplade.

Naar in Draabe Peptonopløsning paavirkes af Lys, the holder of the yderste ultraviolet Straaler, which can passere Bjærgkrystal, men ikke glass, is always 2 minutes, in the giver reaction for Brintoverilte; On this street there is no Lyset, strange reactions derimod first after 3 minutes Forløb. The ultraviolet Straaler ere altsaa ikke ganske uden Betydning for Dannelsen af Brintoverilte, men deres Indflydelse herpaa er dog meget ringe i Sammenligning med deres overordentlig store Andel i Lysets bactericide Evne (se min Afhandling "Om ultraviolette Straalers bactericide Virkning" H. VII p. 56).

b. Af hvad Natur ere de bactericidal substances, the then ved

Belysning af Næringssubstrater. Efter ved these Forsøg at have faaet Kendskab til de Betingelser, hvoraf Dannelsen af Brintoverilte ved Belysning afhænger, kunden jeg gaa over til det andet Afsnit af min Opgave: at undersøge, af hvad Natur det for Bacterierne skadelige Stof er, der ifølge Roux's og mine Forsøg med Miltbrandsporer then ved Belysning af Bouillon og særligt, om which he Brintoverilte.

Every time there are undersøgelsesrække udelukkende anvendt Bacterier i Standet for, som til the tidligere Række, Sporer. Since Roux saaede udvoksede Bacterier i den belyste Bouillon i Stedet for Miltbrandsporer, viste det sig, at de voksede yppigt. The substance that was var i Stand til at forhindre Sporernes Spiring, havde altsaa ingen skadelig Indflydelse paa udvoksede bacteria. However, there is an impediment to sandsynligt, at which there is no principle for the research of the spores and bacteria Paavirkelighed, men at that point for the bacteria to be skadelige Stof then it is større Mængde ved Anvendelsen af et saa overordentlig kraftigt Lys, som det jeg har brugt, maatne det kunte paavirke ogsaa udvoksede bacteria. Ved nogle Forsøg (se Skemaerne p. 86 of) konstaterede jeg, at denne Antagelse var rigtig, idet selv en kortvarig Belysning af Bouillon forsinker Væksten af Bacterier, der saas i den efter Belysningen, og tilstrækkelig long Tids Belysning bevirker, at de gaa helt to reason. Every customer derefter gaa over to at undersøge, om det Stof, the halledes udvikles ved Belysning af Næringssubstrater, he Brintoverilte.

For at kunne gøre dette med nogen Sikkerhed, maatte jeg først skaffe mig et i hvert Fald nogenlunde grundigt kendskab til Brintoveriltets Evne til at dræbe Bacterier. These Forsøg ere gengivne i Afhandlingen: "Om Brintoveriltes baktericide Virkning" (the booklets p. 110), have the fremgaar, at selv i get strong Fortynding kan dette Stof dræbe Bacterier.

Som je tidligere har antydet he det ikke berettiget at slutte, at eftersom der udvikles Brintoverilte ved Belysning af forskellige Vædsker, og eftersom dette Stof kan dræbe Bacterier, er det Aarsag til, at Bacterier gaa til Grunde, naar de saas i de belyste Vædsker. The customer also has large tanks, on the velvety med Brintoveriltet other substances, but bactericidal Even he gets større end dettes, and som derfor hovedsageligere Aarsag til Bacteriernes Tilgrundegaaen. Videregaaende Forsøg customer multiple endogsaa vise, at Brintoveriltet slet ingen Indflydelse har herpaa, idet broths nemlig customer antage bactericide Egenskaber ved in Belysninggrad, the ikke frembringer selv det svageste Spor af Brintoverilte.

Under mine Forsøg paa at bring Klarhed herover he det i høj degrees come mig til gode, at each har bejdet med constant Lys. However, in the foregaaende Forsøgsrække undersøgt, there are longer Betingelser Brintoveriltet kræver for at that time, and later on long Tids Belysning the Stof udvikles in forskellige Vædsker. Som Følge af, at every har arbejdet med constant Lys, kunden jeg derefter in the following Forsøgsrække, under ganske samme Forhold undersøge, om the bactericidal Stof kræver samme Betingelser for then, including om the Tid, hvori de forskellige Vædsker maa udsættes for Lyset , in which the sker, he tilstrækkelig long til, at which can then Brintoverilte i en saadan degree of concentration, at which can dræbe Bacteria.

The Række Undersøgelser, the description in the following, he derfor udførte ganske ligesom de foregaaende, kun med the Forskel, at jeg i Stedet for at gøre reaction paa Brinoverilte har undersøgt, om bacter gik til Grunde, naar de saa edes in Næringssubstratet efter Belysningen . De Vædsker, each belyste, vare delvis de samme, som benyttedes til forrige Række Forsøg, nemlig tre, hvori der thenes Brintoverilte ved Belysning (broth, urine and 1% Peptonopløsning) including tre, hvori dette ikke foregaar (Uschinskys Vædske, Hesteserum og 1 % Peptonopløsning med Tilsætning af mælkesurt Natron).

There is a request for a draft on the upcoming Vædske paa in Bjærgkrystalplade, and then still for the Samleapparatet paa same maade and same sted som i forrige Forsøgsrække. There are also lamps with 35 amperes and 51-49 volts, installed concentration apparatus in 11"), cm. Distance from the positive cool Spids, and overskyllet Bjærgkrystalpladen with cold Brøndvand for at modvirke Opvarmning og Fordampning af Nædelringssubstratet After Belysningen has every bacterium in Draaben and henstillet Bjærgkrystalskaalen with Bunden i Vejret paa authorized Filterpapir in en Petris Skaal, Denne stilledes i Termostat.I the following days saa jeg af and till efter, om Kulturerne vare voksede ud.

Each one has been working with B. prodigiosus and B. coli communis. Jeg has valgt these, fordi de begge vokse yppigt i all de applied secs Næringssubstrater.

For saa vidt muligt at undgaa Klumper, ind i hvilke the bactericidal Stof maaske vilde have vanskeligt ved at trænge, og for iøvrigt at have saa ensartede Forhold som muligt, har jeg udelukkende anvendt Kulturer, hvis Alder variered from 17 to 24 timers.

De p. 73 of requested Forsøg ere Garanti imod, at Vædskens bactericide Egenskab skyldes Udvikling eller absorption of ozone. Imidlertid kunden det jo tænkes, at vædsken 8/11

Other bacteria absorb skeletal air arteries that come from lamps. At that it is not Tilfældet har jeg overbevist mig om ved the following Forsøg:

All lamps burned with 35 amps, and Døre, Vinduer and valve were sealed, said air was called and test tube with broth, so that they were marked with Lyset and a blink cylinder; Indsugningsstedet var omtrent paa Skaalens sædvanlige Plads. Generally speaking, 20 minutes are allowed. - Gennem et andet test tube with broth added to the air i et Værelse, before the ingen Buelampe finds, liteledes i 20 minutes. Derefter saaedes the i begge en lille Øsken af en filtreret 18 Timer gammel Kultur af B. prodigiosus, de stilledes i Termostat og iagttoges hyppigt. The visible sign inen Forskel paa Bacteriernes Udvikling.

Forsøget udførtes 2 courses with the same result.

Lu Meden's lamps burned sugedes the air called broth under samme Forhold that the foregaaende day, men i 30 minutes. I because broth together with i en, gennem hvilken der ikke var suget air, saaedes en Øsken af en 16 Timer gammel, filtreret prodigiosus culture, hvorefter Glassene stilledes i Termostat.

The viste sign inen Forskel paa Væksten.

Old plants are usually attached to lamps and air arters or overhovedet "Luftning" on broths if at least it is suitable for at least aerating substrate for bacteria.

The foregaar brighter ikke nogen Forandring af reactions, som kunden være Skyld i, at bacteria ikke kunne trives i en belyst Vædske. Each has under the oven for Angivne Forhold belyst Bouillon, 1% Peptonopløsning og Urine i %Time, Uschinskys Vædske og Hesteserum i 1 Time, uden at the med Lakmosopløsning kunden paavises nogen Forandring af reactions.

Ved de first 16 Forsøg with broth and 3 with urine saaede any direct fraen culture over in the best Draabe Næringssubstrat. Det kan ikke undgaas, at Antallet af de Bacterier, der føres over i Draaben, bliver meget stort og varierer strærkt, idet det afhænger dels af, before tæt Kulturen he vokset, dels af, before meget the hænger ved Podenaalen. This has to follow, if there is no constant result, if there is a substrate for the supply of bactericidal bacteria, it will be longer than that before the infection is caused by bacteria. Virkningen on the bactericide

2

Stof, which he developed ved Belysning af en Draabe Næringssubstrat, he nemlig i høj degrees afhængig af, before many bacteria of the Saas deri. Each has paavist det ved the following Forsøg.

3/2 Kl. 12–1 Em. En 15 Timer gammel prodigiosus culture filtreres gennem hydrofilt Vat, Filtratet fortyndes med desstilleret Vand; en Øsken af det føres over i 2 cm.: Bouillon. I to Draaber Bouillon, som begge ere belyste i 30 Minutes, saas der med Spidsen af en Podenaal a) directly from Filtratet, b) fra det med Bouillon fortyndede Filtrat.

3

b. Udsæd fra det fortyndede filtrate. 3rd class 1 Em.

Belysningens

Varighed

3/2 Kl. 41/, Em. 3/2 Kl. 81/, Em. 4/2 Kl. 3 Em.), Kl. 10 fm.

2

4, Kl. 3 Em. Omsaaning fra the belyste Draabe over i Bouillon i et test tube. 2 cl. 10 fm. ingen Vækst deri.

Medens faa bacterium, which føres over i en broth, if he belyst in 30 minutes under the next Forhold, blive dræbte, opnaar man altsaa kun about 4 timers Forsinkelse af Væksten, naar man saar many bacteria. The bactericidal substance may also bind to the bacteria or destroy it.

Because the Forsøg havde lært mig, at jeg burden saa fra en meget fortyndet Kultur, har jeg siden brugt the following Fremgangsmaade: jeg har

har fort lille øsken bouillon culture over i 2 cm. S

in

Broth, then rystet, dyppet en lige, tynd Podenaal about 1 cm. ned i den, og derefter dyppet Spidsen af Naalen i den belyste Draabe Næringssubstrat. Paa denne Maade har jeg i hvert Fald opnaaet at overføre forholdsvis faa bacteria, omend ikke et constant Antal; that he vel overhovedet umuligt. Basically, to the Smaavariationer, the stranger finds, Maa sikkert Fremdles søges i the forskellige Antal af Bacterier, which ere førte over i Draaben.

Follow up on that for and talk about Fremgangsmaade har været dels mere constant results, dels en Forkortning af den Tid, hvori jeg maatte belyse de forskellige Næringssubstrater for at opnaa, at de fik bactericide Egenskaber.

De Forsøg, which is the next step, in which it starts at used because Fremgangsmaade, but it is værdiløse, it is not possible to do this together with its own that follows from the forskellige Fremgangsmaade. Jeg har derfor udeladt the af following Skemaer.

I disse Skemaer har jeg fremstillet de Resulter, jeg har opnaaet ved Belysning af de seks oven for nævnte Næringssubstrater. Jeg has saaet Bacterierne umiddelbart efter Belysningen, og i the following days og til undersøgt Draaberne for at se, om the var Vækst i dem. I Skemaerne betegner +, at that var Tilfældet, : betegner, at Bacterierne ikke vare voksede ud.

The customers are already paa, at the ware dræbte, or at de, ligesom Sporerne i Roux's Forsøg, vel ikke ware gaaede to Grunde, men dog brighter ikke kunden for mere sig. If so, I have disturbed Delen af Forsøgene overført lidt af de Draaber, hvori Bacterierne ikke vare voksede ud i Løbet af et Par Dage, til frisk broth. Af Tablerne ses, at denne holdt sig sterile i all de Tilfælde, i hvilke der brighter ikke var Vækst i selve den belyste Draabe. However, it has already been stated that there are no bacteria present in the most common substrate, that the paa is specified, that it is on the other side.

Results after the Ompodning has jeg i Skemaerne betegnet ved s, hvis broths holdt sig sterile, og ved v, hvis the kom Vækst i den. On the heading, hvori Mærket staar, kan man se, paa hvilket Tidspunkt Omsaaningen skete. Jeg har ladet broths henstaa i Termostat i 3-7 days. Naar der i en af Tablernes rubric finds more Mærker (= eller +) betegne de Resultset af lige saa mange Forseg.

To Lettelse af Forstaaelsen af Tafelrne can as an example on Bouillonforsøg No. 4 (p. 87), et af de most indviklede. Det afsluttedes 1/3 1900 Kl. 4 Em. En Bouillondraabe belystes i 10 minutes, 2 i 15 minutes and 3 i 20 minutes. Paa den ovenfor angivne Maade saaedes en 24 timer gammel bouillon culture af B. coli comm. i whom all including i en Draabe, who ikke var belyst (Belysning i 0 Minuter). 2/3 cl. 8 em. var control cultures vokset ud. 3/, cl. 11 fm. var der Vækst i den i 10 minutes belyste Draabe velvet i en af dem, the vare belyste i 15 min Fra den anden af disse, velvet fra de tre, the vare belyste i 20 min, saaedes 3.3 ki, 11 fm. over i et test tube with broth. Denne holdt sig sterile, og endnu 8/3 Kl. 5 Em. var det samme Tilfældet med de 4 Draaber, hvorfra Bouillonen var tilsaaet.

8th

II. Urine.

Belysningens Varighed

No.

Forsøget udated

surveillance

0 5

15 20 min min min min Ma

82 Kl. 8 Em.

1/2 Kl. 3 Em.

1/2 small 7 Em.

:

6/2 Kl. 12 Mdg.

2 1/2 Kl. 12 Mdg.

7th class 2 Em.

12

16

15/2 cl. 4 Em. 10. cl. 10 fm. 16/2 cl. 10 Em. 17/2 cl. 9 fm.

18), cl. 2 em. 19, cl. 10 fm.

· 1:

2

2

species af
bacteria

B. prodig.

do.

do.

do.

53 Kl. 3 Em.

B. coli

* K1. 2 Em.

do.

Class 10 fm.

141, class 2 Em.

ingen Vækst

14 and cl. 4 em. blakket

tydelig Vækst

14

Vækst

blank

19!

/11

Kl. 3 Em.

ingen ingen Vækst Vækst

2

18/1 Kl. 8 Em.

B. prodig.

19/1 Kl. 6 Em. tydelig tydelig

Vækst Vækst

Ushinsky's Vadske (continued).

Belysningens Varighed
species af

surveillance
bacteria

0 30 45 60

min min min min

Nogle særlige forhold ved Serum ville blive omtalte senere (p. 96).

VI. 1% Peptonopløsning with mælkesurt baking soda. (99 cm.3 1% Peptonopløsning + 1 cm.% af en approx. 35% Opløsning af mælkesurt

Baking soda (Mælkesyre, neutraliseret med 20%, baking soda).)

Til Forsøgene med Uschinsky's Vædske maa jeg knytte nogle Bemærkninger. I de first 7 Forsøg saaede jeg med Spidsen af en Podenaal fra en stærkt fortyndet Kultur i Uschinskys Vædske; først i det 8de Forsøg saaede je paa den sædvanlige Maade (see p. 84); Customers of the Forsinkelse af Væksten, the Opnaaedes ved dette Forsøg, can also use the same connection with the tillsvarende Forsinkelse i de other Forsøgsrækker.

Selv ved 60 Minutes Belysning fik Uschinskys Vædske ikke saa kraftig baktericid Evne, at de Bacterier, der saaedes i Draaberne, gik til Grunde, men dens Værdi som Næringssubstrat blev dog forringet; ved 30 minutes Belysning for sinking bacteria Vækst 3—5 timers, and ved 60 Minutes Belysning about 12 timers. Denne forsinkelse he ganske vist ubetydelig, naar man sammenligner f. Ex. med Forholdene i Bouillon; All 10 Minutes Belysning heraf foraarsager nemlig 1--2 Dogs Forsinkelse af Væksten, and 20 Minutes Belysning bevirker, at the Bacterier, der saaes i Draaben, gaa til Grunde; then he can use it, which then causes bacteria to build up. This can not be worn Brintoverilte, after that the fabric can not be then in Uschinskys Vædske. When nature is there, there is no undersøgt. I and saa sammensat Opløsning that Uschinskys kan der ved Spaltning afen eller anden af dens Fondsdele under Lysets Indvirkning let then et skadeligt Stof for bacteria, i Analogi med - hvad Duclaux har paavist at ved Belysning af Raulins Vædske spaltes dennes Vinsyre i Myresyre, Kulsyre above vand; Myresyren bevirker, at Skimmelsvampesporer, der saaes i Vædsken, gaa til Grunde. In addition, there is a strong bactericidal effect, which can also be followed by Vædske opnaa ved Belysning, to the indeholder material, which can be special to the Lyset, and other special products that are available for bacteria. Ovenstaaende Forsøg tyde paa, at the foregaar noget saadant in Uschinskys Vædske, means that for Bacteriernne skadelige Stof then it først efter meget long Tids Belysning and har en meget svag baktericide Evne, saa at the ganske betydningsløst. Hvis man

Collected results from the following Forsøgsrækker in et Skema, comes from this to this room and:

+ betyder, at de Bacterier, der saaedes i Draaberne efter Belysningen, voksede; • betyder, at de ikke voksede, og ? at de undertiden voksede, undertiden ikke.

Ved Sammenligning af the Skema og the paa p. 75 ses, at de tre Vædsker (Peptonopløsning, Bouillon og Urin), som faa bactericide Egenskaber ved Belysning, not top ere de samme, i vilke the udvikles Brintoverilte. I de tre (Uschinskys Vædske, Hesteserum og Peptonopløsning med Tilsætning af mælkesurt Natron), I have the inside Brintoverilte then, opstaar the brighter ikke noget baktericidet substance.

Endvidere ses, at den Tid, i hvilken man maa belyse en Vædske for at opnaa, at de Bacterier, som saaes i den efter Belysningen, dræbes, he omtrent proportionally med den Belysningstid, der kræves til Frembringelse af Brintoverilteaktion. En 1% Peptonopløsning og Urine forholde sig i begge Henseender ens; After 2/2 minutes Belysning gav de Brintoverilterereflex, og naar de vare belyste i 15 Minutes, gik de Bacterier, der saaedes i dem, til reason. The broth may be longer than that, so that it can cause bactericidal Evne and give a Brintoviral reaction, after 20 minutes and 4 minutes.

Finally, more information about the bactericidal substances and brintocides is identical to the Kendsgerning, when you add more sodium bicarbonate to 1% Peptonopløsning, you should be aware of the bactericidal substance and brintocides.

Alt dette tyder paa, at det Stof, paa hvilket de belyste Næringssubstraters bactericide Evne beror, he Brintoverilte. Men det customer tænkes, enten at that var et Stof, which then under the same Betingelser as Brintoverilte og velvety med det, eller at Brintoveriltet ikke direct dræber Bacterierne, men frembringer and kemisk Forandring af Næringssubstratet, raised the udvikles et andet baktericidet Stof.

For at afgøre, om that he Tilfældet, har jeg mig af, at Brintoverilte forsvinder fra Bouillon ved Henstand. If the known Draabe does not contain other scaly substances, then there are bacteria that can be used if the Draabe is not exposed to it, after the first Brintooveriltet it is decomposed.

Forsøgene were the following:

a. Jeg belyste to Draaber Bouillon i 45 Minutes, paa samme Maade som ved de hidtil omtalte Forsøg (see p. 82); The following still applies to the southern part of the Bjærgkrystalskaalene, with Bunden ended opad, paa authorized filter papers in Petris Skaal, and that is because of Stuetemperatur in Mørke. Efter 73/4 Times Forløb customer of ikke paavises Brintoverilte i den ene Draabe. Jeg saaede nu B. prodig. Direct questions about culture over the Andes Draabe, which has the state in 84/2 Time, and about the British Brintoveriltet old days, at the end of the day, there are times when there are forests. After 12 timers Forløb var Kontroldraaben blakket, men i den belyste Draabe var der ingen Vækst; 4 Timer senere var derimod kraftig Vækst i den. Selv paa et Tidspunkt, because the ikke longer customer paavises Brintoverilte i Bouillonen ved Hjælp af iodine potassium klister, customer of the old saa spores en Forsinkelse af Væksten, om end the var meget ringe. Do not behave yourself at any time, broths contain other bactericidal substances, avoid Brintooveriltet var dekomponeret; Som jeg har paavist i Afsnittet,, Brintoveriltes desinficerende Virkning ", there are bacteria and finer reagents paa Brintoverilte and iodine potassium klister. At the efter 84/2 Times Forløb har været lidt Brintoverilte tilbage i Bouillonen, he saa meget the sandsynligere, som je tidligere havde paavist, at a Bouillondraabe, der var belyst i 45 Minuter, gav tydelig reaction endnu efter 6 Timers Stand. You can see the following forsog, when you load the broths longer, the bacteria are allowed in the som i not belyst Draabe.

b. Fremgangsmaaden var den samme ved foregaaende Forsøg, next day, at jeg ikke saaede direct fra en Kultur, men forte in Øsken Bouillonkultur over i 2 cm. Bouillon and dyppede in lige Podenaal først heri og derefter in den Belyste Draabe, ganske ligesom ved de Forsøg, dere beskrevne i Skemaerne. Every 3 draaber i 20 minutes, above that same length, at Bacterierne vilde gaa til Grunde, naar de saaedes deri straks efter Belysningen. Efterat Draaberne havde staaet i Mørke og ved Stuetemperatur i 3 Døgn, paaviste jeg, at Brintoveriltet var forsvundet fra en af dem, og saaede derefter paa den angivne Maade i de to others, including i and ikke belyst Kontroldraabe. After 8 timers Forløb var der ikke Vækst i nogen af dem, men after 20 timers Forløb var the tydelig - and lige kraftig Vækst i dem alle tre. As a result, the known Draaber paa the tidspunkt is not longer than that required for bacterial growth.

Imod this to Forsøg kan der gøres den Indvending, at de belyste Bouillondraaber stod i Mørke; Den Mulighed customer tænkes, at Brintoveriltet spaltedes ved Belysningen, og derved frembragte kemiske Forandringer i Bouillonen, saa at denne fik bactericide Egenskaber. Herimod taler dog, at the then mere Brintoverilte ved long Tids Belysning end ved kort. For at sikre mig har jeg dog gjort the following Forsøg:

a. 13/1, 1899. En Brintoverilteopløsning, som heldt Svovlsyre, neutralized with Barytvand; After Fortynding med distilled Vand gav the endnu meget strong reaction. In Draabe heraf belystes paa sædvanlig Maade i 45 minutes.

Derefter gav den Fremdles meget strong reaction.

b. 14/1, 1899. Neutraliseret Brintoverilteopløsning fortyndedes med saa meget distilled Vand, at the kun gav en ganske visible tydelig, men dog hastigt forsvindende reaction. Efterat in Draabe deraf var belyst i 60 Minutes paa samme Maade som ved forrige Forsøg, gav the foreign league strong reaction.

Brintoveriltet dekomponeres altsaa ikke ved at udsættes for Lyset.

However, it is still possible to wait until the slide on mine Forsøg, on the bactericidal substance, then on Belysning on Visse Vædsker, he Brintoverilte.

Lysets Virkning paa Serums bactericidal substances.

I det andet af de p. 91 beskrevne Forsøg med Hesteserum voksede Bacterierne godt i den belyste Draabe, men slet ikke i Kontroldraaben. Jeg blev overrasket herover, for that jeg ikke havde ventet at find bactericidal substances in the used serum; This has been reported in the laboratory for about 2 years, and these serums have bactericidal activity, which is clearly indicated as a result. Since the next

Forsøg tydede paa, at Lyset detruerer Serums bactericidal substances, undersøgte jeg nærmere, om which he Tilfældet.

28/3 1900. The udvalgtes 2 test tube af 14 mm. Diameter med 2 cm.3 Hesteserum i hvert. Det a belystes in 1/4 Time with 35 Ampère and 11"/. cm. Distance between the Kulspidsen and the rest of the lens; under Belysningen praise the cold Vand ned over Glasset andet test tube blev ikke belyst Efter Belysningens Slutning Kl 21/2 Em førtes en Øsken af en 22 Timer gammel Bouillonkultur af Bac en Øsken af Serumet til Spredningskultur i Agar. The lavedes to Spredninger fra hvert Glas. Begge Serumglasene stilledes i Termostat og undersøgtes af og til. For following Bacteriernes Aftagen eller Tiltagen i Antal saa nøjagtigt som muligt lavede jeg fra Tid til anden Spredningskulturer i Agar Paa Samme Maade that umiddelbart efter Tilsaaningen.

Ved Belysningen blev det oprindeligt straagule serum belegere, next farveløst.

Serumglassene forholdt sig paa the following Maade:

29/3 91/2 Em. Ikke Vækst i noget af Glassene.

30/3 4 Em. Det ikke belyste serum he clarifies strangers. I det belyste finds derimod in Mængde smaa Klumper og et Bundfald.

The saaes over i frisk broth fra begge glass.

30/3 7 Em. The broth, hvori he sows fra det belyste serum, he blakket, the other he clear.

31/ 11 Fm. Fremdeles ingen Vækst i den Bouillon, hvori he saaet fra det ikke belyste serum. Det var altsaa sterile allerede 30/3 4 Em.

With microscopic analysis of the most recent serum, there are bacteria present and there are many bacteria and there are isolated individuals.

I Agar-Spredningerne fra Serumglasene (2 fra hvert glass) found the following Antal colonizers:

3

Results from Forsøget var oldsaa, at i det ikke belyste Serum after Bacteriernes Antal uafbrudt; 2 Døgn efter Tilsaaningen konstateredes baade ved Spredning i Agar og ved Omsaaning i Bouillon, at the var sterilt. I det belyste Serum after Bacteriernes Antal ligeledes in the first Døgn, men forøgedes derefter saa stærkt, at the efter det andet Døgns Forløb var then Bundfald.

Med andre ord: Serumet contains bactericidal substances, som bleve destroyed af Lyset*).

I det næste Forsøg træder that endnu tydeligere frem, for that each har saaet more bacteria in serum glass and belyst lidt longer.

4/4 1900. Same Fremgangsmaade as from forrige Forsøg. Belysningen varede i 14/2 Time.

Lavare Bacterierne voksede ud i det belyste serum; the foundtes, ligesom i forrige Forsøg, et Bundfald, largely existing af Bacteriehobe.

4 states that Omsaaning til Bouillon, at Mørkeserumet var sterilt.

I det first af de p. 91 beskrevne Forsøg voksede Bacterierne omtrent lige saa godt i Kontroldraaben som i den Belyste Draabe. This is done on a regular basis in the Udsæd end in Andet Forsøg, idet som known in vis Mængde bactericidal substances in serum kun kan dræbe vis Mængde Bacterier. This is indicated by the following forsog:

21/4 3 em. I 2 cm 3 serum saaede jeg: 1. En Øsken af 1 cm. 3 Bouillon, hvori the var opslemmet en Øsken af en 16 timer gammel broth culture af B. coli. 2. Med Spidsen af en Podenaal direct fra cultures. 3. Med en Øsken direct fra cultures.

*) Efter Forsøgenes Afslutning fik jeg at vide, at Buchner allerede har paavist, at Lyset destructive serums bactericidal substances.

23/4 10 fm. 1 Reagensglassene No. 1 and 2 ingen Vækst, men i No. 3 strong Vækst (Bundfald).

3/5 vare bacterierne ogsaa voksede ud i test tube No. 2.

Fra Tid til anden lavede jeg Spredningskulturer with 1 Øsken Serum, ligesom i de foregaaende Forsøg. Results at Tællingerne var the following:

The serum, which is used, says that it's gammelt, but it doesn't happen that there are bactericidal substances in it. At Bacteriernne voksede bedre i belyst Serum end i ikke belyst, tænkte jeg muligvis kunde skyldes, at the ved Belysningen thenes Næringsstoffer, ligesaa vel som at der ødelagdes bactericide substances. That bliver i high degree of usandsynligt, after that you see sig, at the opnaas det samme ved at saa en rigelig Mængde Bacterier i Serumet som ved Belysning af det.

II. Bestaar Lysets bactericidal Evne i en direct Virkning paa Bacterierne eller i en indirect Virkning, ved Udvikling af et baktericidet Stof i Næringssubstratet, eller i en Sam

work on begge factors? I forrige Afsnįts Forsøg har jeg paavist, at der kan thenes et for bacteria skadeligt Stof ved Belysning af visse Næringsvædsker. Uagtet the fabric can then be i saa stor Mængde, at the dræber bacterium, the saaes i Vædsken efter Belysningen, he gives the dog ikke, at the bidrager til at dræbe bacterium, the finds i Vædsken, medens den belyses, eller med andre ord, at det har nogen Andel i Lysets bactericide Virkning. Det customer tænkes, at Bacterierne gaa til Grunde ved Lysets direct

Indvirkning length for the Stofer udviklet i saa stor Mængde, at which kan paavirke dem skadeligt. At Bacteriernes Tilgrundegaaen ved Belysning i fald ikke udelukkende beor pa Udviklingen af et baktericidet Stof, kan sluttes alene deraf, at Lyset kan dræbe Bacterier, dere opslemmede i distilled Vand eller indtørrede direct paa en Plade, uden at være i Berøring med noget substrate . Selv om Lysets baktericide Virkning ikke udelukkende beor pa Udviklingen af et baktericide Stof, behøver dette dog ikke at være uden Betydning.

Ligesom ved foregaaende Afsnits Undersøgelser ligger det nærmest at tænke paa, om Udviklingen af Brintoverilte bidrager til, at Bacterierne gaa til Grunde ved Belysning. If there are more than Richardson and Dieudonné, at which he Tilfældet, which Kruse requires.

Granddaughter of mine tidligere Forsøg can bidrage to solve the Spørgsmaal. I Afsnittet "Om ultraviolet Straalers baktericide Virkning" has any paavist, because it is extremely powerful, under the used forhold omtrent 10 Gange saa powerful that virkningen af hele the other spectrum. Ved et andet Forsøg (p. 80) found jeg derimod, at om end de ultraviolet Straaler have nogen Betydning for Udviklingen af Brintoverilte i en Peptonopløsning, er den dog meget ringe i Sammenligning med deres baktericide Virkning, idet den Belysningstid, der krævedes til Udviklingen on Brintoverilte, kun forhødes from 2 to 3 minutes ved at these Straaler udelukkedes.

I et af de tidligere Afsnit har jeg paavist, at Bacterierne kunne dræbes af Lyset, ogsaa naar al llt er fjærnet, om end Lysets Virkning formindskes herved. Derimod synes Tilstedeværelsen af Ilt at være en Betingelse for Udviklingen af Brintoverilte ved Belysning, ifølge Richardson's, Dieudonné's og mine Forsøg.

Disse Forsøg tyde altsaa imod, at Brintoverilte har nogen Betydning for Lysets bactericide Virkning.

Ogsaa Forsøgene i forrige Afsnit gøre det i høj degree used and synligt, at Lysets bactericide Virkning skulde favorable ved at the udvikles Brintoverilte eller noget that helst andet Stof ved Belysning af Næringssubstratet. Bacteria dræbes nemlig i Løbet af faa Sekter af det Lys, der maatte paavirke Næringsvædskerne i 10—20 Minutes, for at kunne meddele dem saa stærk bactericide Virkning, at Bacterier, der saaedes i dem efter Belysningen, gik til Grunde. Afgørende he did not imidlertid ikke, thi ve coming fabric customer jo virke more powerful in statu nascendi.

For at faa afgjort, om Udviklingen af Brintoverilte har nogen Andel i Lysets bactericide Virkning, har jeg belyst Bacterier, der vare opslemmede i forskellige Vædsker, dels saadanne, hvori der dannes Brintoverilte ved Belysning, dels saadanne, hvori dette ikke foregaar; derefter har jeg ved Hjælp af Spredningskulturer og Tælling states, in other Vædsker Bacterierne først gik to Grunde. De Vædsker, each has brugt, vare: distilled Vand, 5%. Druesukkeropløsning, 5% peptonopløsning and bouillon; Because of the same as used to forsøgene in previous Afsnit. I de to førstnævnte Vædsker kan der ikke udvikles Brintoverilte, by the foreign and typical reaction in 1% Peptonopløsning and Bouillon from henholdsvis 2/2 and 4 Minutes Belysning with concentrated Lys from a 35 Amp. Lamp, which has 11°/2 cm. Distance from the concentration apparatus.

Ved these Forsøg afgøres ikke alene, om Udviklingen af Brintoverilte bidrager to Lysets bactericide Virkning, men ogsaa, om noget som helst andet kemisk Stof har en saadan Betydning. The amount that can be given at the distiller's van and can't be then no longer contain chemical substances in Belysning; hvis Bacteriernes Tilgrundegaaen paaskyndes ved Udviklingen af et saadant, maa de derfor dræbes fastere i en Vædske, hvori dette foregaar, end i distilled Vand. De fire nævnte Vædsker har jeg valgt, fordi jeg mener at turde gaa ud fra, at the paagældende fabric i hvert maa kunne then i en af dem. I find that there is a representation of bad Kulhydrater (in Druesukkeropløsning), with many Roux elements, in the bactericidal Processes paaskyndes, and the same organs Kvælstofforbinderelser (in Bouillon and Peptonopløsning), the ifølge mine tidligere Forsøg ere in Betingelse for, at the bak then can Stoffer i en Vædske.

To Belysningen he used the Fremgangsmaade, so he wrote about No. III. i H. VII p. 54 (Belysning af en Draabe af Bacterieopslemningen og Tælling af de tiloversblevne Bacterier ved Hjælp af Spredningskultur). Jeg ha gjort opmærksom paa, at denne Fremgangsmaade he the least necessary af de tre, jeg ha brugt. Som det kan ses af de i the following meddelte Skemaer he Forskellen mellem Bacteriernes Modstandskraft i de forskellige Vædsker imidlertid saa betydelig, at the vilde kunne paavises endogsaa ved and reached grore method. Jeg havde desuden ikke many Fremgangsmaader at vælge imellem. Under Belysningen maatte Bacterierne nødvendigvis være opslemmede in de Vædsker fire, hvis Indflydelse paa den baktericide Virkning jeg vilde prøve; You can do that on the (Bouillon and Peptonopløsning) you can bruges the Næringssubstrat. That has to be done on the other side of the road at the end of the line on Vædsken over i et Næringssubstrat efter Belysningen. Som follow af, at each brugte Spredning i almost substrate, customer then follow Bacteriernes successive Tilgrundegaaen in all dens Trin, til Trods for de mindre Uregelmæssigheder, the vare en Følge af, at Øskenen ikke oldid rummede lige megen Vædske.

All Forsøgene have 18 amps, 51-49 volts and 20 cm. Distance from the lens to the concentrating apparatus on the øversste lens.

Forsøg No. 1. 18/9 1899. B. prodigiosus.

The afmaales 9 cm.3 af in 5% Peptonopløsning, 5% Druesukkeropløsning, Bouillon and distilled Vand. En 16 timer gammel broth culture af B. prodigiosus filtreres gennem hydrofilt Vat; on the filtrate for 1 cm. over i 9 cm. Distilled Vand, has atter 1 Draabe føres over i hvert af ovennævnte glass with 9 cm. 3 Vædske; herfra føres Draaber over paa Bjærgkrystalplader and belyses; derefter laves Spredningskulturer af en Øskens Indhold.

3

3

If the forsøg kan sluttes, at i high fald Druesukkeropløsning ikke udvikler et Stof, som paaskynder Bacteriernes Tilgrundegaaen, idet these forholde signs, enten de belyses heri eller i distilled Vand. At de dræbes senere ved Belysning i Bouillon og Peptonopløsning end i distilled Vand og Druesukkeropløsning, kunden bero paa, at Absorptionsforheldene ere forskellige that follow af Vædskernes forskellige color, beforehand he ganske usandsynligt, at dette jersom have noget at dreefters saa tyndt et Lag. At the results of the forsøget not mentioned for other things, ses af the following:

Forsøg No. 2. 297, 1899. B. prodigiosus.

On the next day, at each day Vædskerne med Karamelopløsning, var Fremgangsmaaden den samme ved forrige Forsøg. Vædskerne belystes in the following orders: Vand, Druesukkeropløsning, Bouillon, Peptonopløsning.

Forsøg No. 3. 14/10 1899. B. prodigiosus.

Fremgangsmaaden var den samme ved forrige Forsøg. Cultures var 16 timer gammel. Vædskerne bleve belyste i den Rækkefølge, hvori de ere requested. Indenfor hver Række angive Numrene øverst i Kolonnerne den Orden, hvori Draaberne belystes (altsaa 60 sec. f ø rst, 0 sec. sidst). Each has foretaget Forsøget in the Order, for the Bacteriernes Vitalitet jo formindskes ved Opholdet in the distilled Vand.

Before meget the bactericidal process forsinkes ved at Bacterierne ere opslemmede in Bouillon or Peptonopløsning in Stedet for i distillet Vand or Druesukkeropløsning, ses bedst, naar one begtter all tre Forsøg under et, ved at addere Tallene in de til hverandre svarende columns; herved opnaas en delvis Udligning af Uregelmæssighederne.

This Forsøg vise, at Bacteriernes Modstandskraft mod Lyset ikke paavirkes af, om de ere opslemmede i Druesukker opløsning eller i distilled Vand, men at de dræbes fastere i disse to vædsker end i Bouillon og Peptonopløsning. You can't say that there aren't any frakende Næringssubstratets Art en vis Indflydelse paa denne Proces, because he doesn't have room at forest, at the i Druesukkeropløsning og distilled Vand udvikles et Stof, that's paaskynder Bacteriernes Tilgrundegaaen. Man maa gaa ud fra Forholdene ved distilled Vand, because the ikke kan foregaa nogen kemisk Process ved Belysning af det, og sammenligne Forholdene i de other Vædsker dermed. It is possible to suck, at Lyset direct pair of bacteria, and no bactericidal substance that is melted, then at the broth and Peptonopløsning foregaar no, so that modker denne Processes.

Selv om man giver Slip paa den gamle Teori, at Lysets bactericide Virkning he mere eller afhængig af kemiske Processer in de Vædsker, hvori Bacterierne ere opslemmede, staar man ingenlunde and Midler till at forklare, at Bacterierne gaa fastere til Grunde in nogle Vædsker end i others You can also rent a physical forhold.

The customer tænkes, at Vand and Druesukkeropløsning absorbere for chemical Straaler end Bouillon and Peptonopløsning. Eftersom all Vædskerne havde samme gule Farve kan der ganske vist ikke have været synderlig Forskel paa Absorptions af blaa og violet Straaler; The customer does not want the spectroscope to be below the surface and 1.5 cm. Tykt Lag. Dette udelukker imidlertid ikke, at the customer være betydelig Forskel i absorptions of ultraviolet rays. For at faa afgjort, om that he Tilfældet, found that the hensigtsmæssigt at using the bactericide Virkning som Maal for Indholdet af ultraviolet Straaler, idet Bacterierne vistnok ere følsommere overfor this end noget kemisk Stof.

Foreget var following:

Af en filtreret broth culture af Bac. prodig. for 2 Draaber over i 50 cm.: distilled Vand. Draaber heraf udsattes for koncentreret Lys paa samme Maade som ved de foregaaende Forsøg. I Lyskeglen var indskudt et Bjærgkrystal-Lysfilter med 11 mm. Lysning. It comes with 5% Peptonopløsning or with the distilled Vand, which has given the same Color as Peptonopløsningen with High Caramel. For assembly purposes, each and every lag is 15 mm. Tykkelse; because the lag, gennem

Hvilket det elektriske Lys passerede, kun var 11 mm. Tykt, vilde en eventuel Unøjagtighed gøre sig minder gældende her. – Efter Belysningen lavede jeg som sædvanligt Spredningskulturer. Den, who skulde benyttes som Kontrol, lavede jeg sidst. Results are the following:

0

Lyset already has the same bactericide virus, so that it has its own 5% Peptonopløsning, so that it has its own distillation and then the same color. Selv i et 11 mm. tykt Lag have these Vædsker altsaa samme absorption levels over for ultraviolet rays; i et saa tyndt Lag som en Draabe er der selvfølgelig endnu minde Mulighed for at den kan være forskellig.

When bacteria are faster to the bottom of the distilled Vand and Druesukkeropløsning end in Bouillon and Peptonopløsning can also not be more than, these Vædsker have significant absorption levels over for ultraviolet rays.

Derimod Tror jeg at have fundet Forklaringen ved the following Forseg:

Each lavede to Opløsninger of Klornatrium, at a rate of 1% and at a rate of 10%. I 100 cm. af hver overførte jeg 4 Draaber af en filtreret prodigiosus culture. Derefter belyste jeg paa samme Maade som ved de tidligere beskrevne Forsøg (18 amp., 20 cm. distance). Kontrolspredningen lavede jeg sidst for at overbevise mig om, at Bacterierne ikke havde days Skade af Opholdet in den stærke Klornatriumopløsning.

0

When the bacteria are opslemmede in en Saltopløsning, he their Modstandkraft imod Lyset altsaa i høj Degree afhængig af Opløsningens degree of concentration. Hvori then Indflydelse paa Lysets bactericide Virkning nærmere beset bestaar, kan jeg ikke angive med Sikkerhed, men jeg formoder, at the dybere liggende Aars he den forskel i Lysbrydningen, which he en consequence af the forskellige degree of concentration. Lysbrydningen maa nemlig nødvendigvis have stor Indflydelse paa Lysstraalernes Gang igennem in Vædske og de Bacteria, der Ligge i den. Hvis these have the same Brydning exponent that Vædsken ville Straalerne gaa lige igennem dem uden at Brydes. Men hvis vædsken he stronger brydende end bacteria, ville disse fungere as Spredelinser, og omvendt, hvis bakterierne ere ærkest brydende , ville de samle Straalerne. Hertil come, at ved Straalernes Overgang fra the stronger building substance to the larger building, ville de paa reason af Fladernes stærke Krumning være object for reflection.

Det forekommer mig, at man i Brydningsforholdene har en rimelig Forklaring af den Kendsgerning, at Bacterier gaa lettere til Grunde i en stærk Klornatriumopløsning end i en svag, og at atter den Indflydelse, Vædskernes forskellige Koncentrationgrad har paa Lysets bactericide Virkning After that, the bacteria in the required preparations are faster to the bottom in the distilled Vand and Druesukkeropløsning and in the Bouillon and Peptonopløsning.

Summary:

1) Naar Bouillon udsættes for Sollys eller concentrated elektrisk Buelys, udvikles der i den et Stof, that prevent Miltbrandsporers Spiring (Bekræftelse af Roux's Forsøg).

2) Ved Anvendelse af tilstrækkelig kraftigt koncentreret elektrisk Lys udvikles dette Stof i saa stor Mængde, at ogsaa Bacterier (Bac. prodig.), der saas i Bouillon efter Belysningen, gaa til Grunde.

3) The bactericidal substances then contained in the broth, urine or Peptonopløsning, but there are none in the Uschinskys Vædske, Hesteserum or Peptonafløsning, the individual mælkesurt Natron.

4) The bactericidal substance contained in the broth from the stand.

5) The then Brintoverilte ved Belysning af Kødafkog ned

% Klornatrium, Bouillon, Peptonopløsning or Urine, men ikke ved Belysning af distilled Vand, Peptonopløsning, der indeholder mælkesurt Natron, Uschinskys Vædske, Hesteserum eller Opløsninger af Druesukker, Rørsukker, Chlorammonium or oxalsur ammonia. Brintoveriltet then altsaa kun i Vædsker, the indeholder sammensatte organke Kvælstofforbinderelser; The latter for hindres ved reducing substances (mælkesurt soda).

6) Mængden af udviklet Brintoverilte stiger ined Lysstyrken og Opløsningens Styrke.

7) I en Peptonopløsning, if Ilter er uddreven, then no brintoverilte.

8) Udviklingen af Brintoverilte skyldes Virkningen af de kemiske Lysstraaler.

9) The first ultraviolet rays, which cannot be made with their own glass, can be applied to Udviklingen af Brintoilte.

10) Brintoveriltet forsvinder fra Bouillon ved Henstand.

11) Since these 1)-4) omtalte bactericidal substances are together with Betingelser for then as Brintoverilte, and since de begge svinde ved Henstand, har jeg sluttet af mine Forsøg, at these to Stoffer ere identiske.

12) Serums bactericidal substances tilintetgøres af Lyset.

13) Bacteria (Bac. prodig.) dræbes fastere af Lyset, to deere opslemmede in distilled Vand or 5% Druesukkeropløsning, end to deere opslemmede in Bouillon or 5% Peptonopløsning, and also to Vædskerne ere farvede in samme degree with caramel. Since there is no foregaa nogen kemisk Processes ved Belysning af distilled Vand, kan man heraf slutte, at Lysets bactericide Virkning ikke afhænger af Dannelsen af et baktericidet Stof in the Vædske, hvori Bacterierne finds, men at den bestaar i en direct Indvirkning paa Bacterierne.

14) Bacteria dræbes faster in 10% Klornatriumopløsning end in 1% Opløsning.

15) Det i 13) og 14) nævnte skyldes sandsynligvis Forskellen ¡ Vædskernes Brydning exponent.

BRINTOVERILTED DISINFECTANT

VIRKNING*)

AF

VALDEMAR BIE

Undersøgelserne af Brintoveriltes disinfecting Virkning have many liability to Formaal at Konstater, om the Stof kan bruges til at disinfecter Drikkevand, f. Ex. i Tilfælde af Tyfus- og Koleraepidemier.

VAN HETTINGA TROMP found, at Brintoverilte i Forholdet 1: 10000 i Almindelighed steriliserer Vand i Løbet af en Dag, men at den disinfecting power he afhængig af Bacteriernes Antal og Art. F. Ex. steriliseredes Vand med 19600 Kim i 1 cm.3 i Løbet af en Dag af H., 0, 1:50000; en anden Vandprøve med 34850 Kim steriliseredes first af H, 0, 1:10000 i Løbet af samme tid. Tromp found ogsaa Forskel paa Tyfus- og Kolerabacillers mod stamina.

UFFELMANN gjorde Tromps Forsøg efter, with the result, at itself in Fortyndingen 1:5000 or endogsaa 1:3000 dræber H, 0, ikke Kimene i Vand saa sikkert som Tromp angiver.

Paa Uffelmanns Opfordring gjorde ogsaa ALTEHOEFER Tromps Forsøg efter, og found ligeledes, at selv i Fortyndingen 1:5000—1:2500 kunden Brintoverilte ikke sterilisere relatively kimfatigt Brøndvand (560-1800 Kim i 1 cm.) eller fortyndet Cloakvand med rigigt Bacterieindhold. Med Fortydingen 1:1000 opnaaede han bedre result; dog var der endnu efter 24 Timers Forløb 3—10 Kim i hver cm.3 tilbage i Drikkevand, der oprindelig indeholdt 160, 600 og 6000 Kim i 1 cm.%. Fortyndet Kloakvand steriliseredes derimod.

I Sammenligning med these tre Forsøgsrækker have the following Forsøg kun rings Betydning, for the slet ikke he days Hensyn til Bacteriernes Antal.

*) Afhandlingen har været trykt tidligere som Del af min Doktorafhandling.

GIBIER found, at ved Tilsætning af Brintoverilte in en Mængde af 1.5 % til Kulturer af forskellige microorganisms dræbtes this i Løbet af faa Minuter.

PANE paaviste, at en Opløsning af Brintoverilte af 8 volume percent Styrke (3: 1 vol. udvikler ved sin Sønderdeling 8 vol. Ilt) dræber Miltbrandsporer i Løbet af 15 min., Staf, pyog. aur. paa 5 min., Tyfus- and Kolerabaciller paa 1 minute.

HEIDENHAIN beskyttede Mælk imod Gæring ved Tilsætning af H, 0, i forholdet 1:10.

TRAUGOTT paaviste, at Brintoverilte he practically used for disinfection on Tøj, diarrhoeiske Udtømninger mm

Most interesting GOTTSTEIN Forsøg. Han undersøgte, had the previous indication to the bacteria and other Cellers Evne at column Brint. overaged ligger. One had more troet than Evne skyldtes Cellernes Indhold af Enzymer; Gottstein paaviste, at the beror paa Nucleinindholdet. Pepsinfordøe every Celler og Celler, which is above Torring eller Antiseptica, column next to Brintooveriltet ligesaa godt that levende

Celler. Gottstein tror, at det drejer sig om en ren kemisk Proces ikke om en Kontaktvirkning som ved f. Ex.

When Hensyn till the i det foregaaende Afsnit omtalte Forsøg var det ønskeligt at have et noget sikrere Kendskab til Brintoveriltets bactericide Virkning end each customer faa ved Gennemlæsning af the referered Litteratur. You have tested the following forsog:

3

Forsøg No. 1. 19/12 1899 (hertil tables p. 113).

In Brintoverilte-Opløsning (Handelsvaren, som indeholder Svovlsyre) neutralized with Barytvand and filtered. The titreredes med en Opløsning af manganese covered Kali, before 100 cm. svarede til 0.2368 grams available Ilt== 0.5032 grams. Brinoverilte. The used Brintoverilte Opløsning contains 1.3% Brintoverilte. Den kogtes i Koch's sterilizer; hverken herved eller ved Autoclaving ved 115° i 10 min. for andredes dens Styrke kendeigt.

Brintoverilte-Opløsningen fortyndes in Forholdet 1:10, 1:100 and 1:1000. Fra these fortyndede Opløsninger for 1 Draabe over i 2 cm. Bouillon and 2 cm.3 distilled Vand; til other 2 cm.3 on these Vædsker tillsattes 1, 2, 4, 12 and 34 draaber (= 1 cm.”) on the ufortyndede Brintoverilte-Opløsning; finally afmaoldes 2 cm. ufortyndet Opløsning.

3

Umiddelbart herefter (Kl. 8 Em.) saaedes i hvert af this test tube 1 stor Øsken af en 24 Timer gammel Bouillonkultur af Bac. coli. Desuden saaedes 1 Øsken i 4 glass med 2 cm.; distilled Vand and i 2 glasses with 2 cm.' Bouillon. Øskenen contains saa many bacteria, at vædskerne bleve svagt blakkede. Test glass still in the thermostat 37o.

20/12 8 Em., altsaa 24 Timer efter Tilsaaningen, saaedes the over i frisk broth from the broth glass, hvori Bactererne endnu ikke vare voksede ud, including from all Glassene med distilled Vand.

Forsøgets result var, at Bacterierne en Øskenfuld af en 24 timer gammel bouillon culture – bleve dræbte af en 0.01884° % Opløsning, som heldt ialt 0.38235 milligram Brintopilte, men ikke af en 0,001884 % Opløsning, som heldt 5.03823 milligrams of brintoverilte. Bacteria were quick to the bottom of the broth and the distilled water. If there are Vækst forsinkes af en endnu svagere Opløsning, one can not se af the Forsøg, since each ikke har undersøgt Glassene in the first 14 timer efterat de vare tillsaaede. In the next Forsøg har jeg undersøgt dette nærmere, ved at Bruge svagere Opløsninger med at least Spring imellem Fortyndingens Grader, including ved at iagttage Reagensglassene hyppigere.

Forsøg No. 2. 16/1 1900 (hertil Tischerne p. 114 og 115).

In Brintoverilteopløsning neutraliseres with barite and filters. Ved Titrering med the for omtalte Opløsning af manganese oversurt Potassium determines the H2O2-Indhold till at være 1.6354° Derefter koges in 10 min. in Koch's steam sterilization apparatus. Efter Kogningen includes Opløsningen 1.585% H, Og. The laves Fortyndinger med distilled Vand i Forholdet 1 Brintoverilte : 2 Vand, 1:5, 1:10, 1:25, 1:50, 1:100, 1:500, 1:1000. After this Forty ndinger, together with the actual 1.585% Opløsning, until 1 Draabe til 2 cm.: Distilled Vand og 2 cm. Bouillon (1 cm. 3

32 draaber). I hvert test tube saaedes 16/1 Kl. 11°/2 Em. en stor Øsken broth culture af B. prodigiosus; indtil 18%, still from the test tube

3

3

3

1

2 a

2 B

ingen Vækst

ingen Vækst

do.

do.

do.

do.

do.

3 a

3 b

4 a

4 b

5 a

5 b

6 a

2 cm. ufortyndet Opløsning 1 cm. 3 H,O, + 1 cm. Bouillon.

do. + 1 cm.: Vand

12 Draaber H, 0, + 2 cm.

s broth

do. + 2 cm.3 vanes

4 Draaber H_2O_2 + 2 cm.S broth..

do. + 2 cm.3 vanes

2 Draaber H20, + 2 cm.” Bouillon..

do.

+ 2 cm.3 vanes.

1 drawer H.02 -+ 2 cm. bouillon

do. + 2 cm.3 vane . 1/10 Draabe H, 0, + 2 cm. Bouillon.

0.026

0.013

do.

0.00459

do.

0.00153

do.

0.000765

do.

0.0003824

do.

0.00003824

1.3

0.65

do.

0.195

do.

0.072

do.

0.037

do.

0.0188

do.

0.00188

20/12 Kl. 8 Em.

do.

do.

do.

do.

do.

do.

do.

do.

do.

do.

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do.

3

ingen Vækst

3

ingen Vækst

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3

blank

1/100 Draabe H, 0, + 2 cm. Bouillon. 0.000003824

+ 2 cm.3 Van..

do.

1/1000 draabe H,O, + 2 cm. Bouillon. 0.0000003824

do.

+ 2cm. Van..

do.

0.000188

do.

0.0000188

do.

1

blank

3

do.

blank

paa et mørkt Sted i Stuen om Natten, for at undgaa for hastily Vækst af Bacterierne; ellers stode de i Termostat ved 22-24

II. Bouillon.

Indholdet af Brintoverilte var som i de tillsvarende Number i forrige Række.

Glass

No.

I b

2 B

3 b

115

4 b

2

5 b

1125

6 b

20/1 small 5 Em.ingen Vækst. 21/1 Kl. 3 Em. strong 1 Draabe H,0, + Brintoverilte reaction. The saas over i frisk broth. 2 cm. bouillon

23/1 Kl. 9 Em. ingen Vækst i denne.

20/1 Kl. 5 Em. ingen Vækst. 21/1 Kl. 3 Em. tydelig 12 do. do.

Brintoverilte reaction. Omsaaning. result as required. do. do. 19/1 cl. 11 fm. ingen Vækst. 201 cl. 9 fm, blakket.

18/1 Kl. 8 Em. ingen Vækst. 19% cl. 11 fm. plumret, 1/10 do. do.

men ikke saa meget som No. 5 b.

17/, Kl. 77, Em. ingen Vækst. 17/ class 11 em. Vækst. do. do.

18/ cl. 10 fm. tydelig Vækst.

17/1 Kl. 7, Em. ingen Vækst. 17/1 cl. 11 em. Vækst. 1/50 do. do.

18/1 cl. 10 fm. tydelig Vækst.

17/ Kl. 5 Em. ingen Vækst. 171 Kl. 71/2 Em. tydelig 1/100 do.

do.

Vækst, men less krastig end i No. 8 b. 17/1 Kl. 4 Em. ingen Vækst. 17/1 cl. 5 Em. Vækst,

men afgjort ikke saa strong som i no. 9 b, 10 b og */600 do.

do.
11 b. 17/1 small 74/2 Em. tydelig Vækst, men stadig ikke

saa strong som i de 3 following.

17 Kl. 4 Em. ingen Vækst. 17/1 Kl. 5 Em. ligesaa 1/1000 do. do.

tydelig Vækst as i control culture. control glass med

17/, cl. 4 Em. ingen Vækst. 17/, class 5 Em. tydelig Vækst. bouillon

do.

7 b

8 b

9 b

10 b

11 b

I have forsøg var Brintoveriltets bactericide Evne forskellig, eftersom det var fortyndet med distilled Vand eller med broth. Bacterierne dræbtes in vandig Opløsning of 0.0024% Styrke, men ikke i in 0.001% Opløsning. I Bouillon dræbtes Bacterierne først af en 5 Gange saa stærk Opløsning (0.012%), derimod ikke

af en doublet saa stærk Opløsning (0.005%). Tilstedvaerelsen on the first organs and multiple reducers

Stoffer synes altsaa at kunne formindske Brintoveriltets Evne til at dræbe Bacterier. Selv under this Forhold har Brintoverilte imidlertid en overordentlig strong Virkning. Finally, higher Opløsninger forsinke

Bacteriernes Vækst reaches. I dette Forsøg kunden jeg recognized en tydelig Forsinkelse i Glasset No. 8 b: because broth contains approx. 0.00005% H,0, (alt 0.00099 milligrams), dvs 1 Del H, O, i 2 million Dele broth. Schönbein angiver, at han med sin iodine-potassium-Stivelse reaction can paavise Brintoverilte in Fortyndingen 1:1 million; each har med then reaction can paavise 1 : 600000; Bacterium ere altsaa et finere reagent paa H,02 end Schönbein's reaction.

The following Forsøg udførtes paa omtrent samme Maade som de foregaaende:

0

3

Forsøg No. 3. 22/1 1900.

En neutralized 1.35864% Brintoverilteopløsning fortynds with distilled Vand i holdet 1 +9. Derefter koges den i kochs steam sterilizer i 20 minutes. He doesn't titreret efter Kogningen; den nedenfor angivne Styrke af Fortyndingerne he derfor snarest for stor.

To 2 cm. Bouillon tilsættes 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10 draabers (1 cm. 34 draabers). Umiddelbart derefter, Kl. 3 Em., føres en lille Øsken af en 24 Timer gammel Bouillonkultur af Stafylococcus pyog. aur. over i hvert test tube. Kl. 8 Em., altsaa 5 timers senere, lavedes control culture.

26/1 Kl. 4 Em. saaedes om i ny Bouillon fra No. 4-8. 29%ı class 10 fm. var der ingen Vækst i this glass. Jeg gjorde denne Prøve, fordi jeg tænkte mig Muligheden af, at Brintoveriltet ikke dræbte Bacterierne, men hastigt destroyed, og derved Frembragte Forandringer i Bouillonn, der havde til Følge, at Bacteriernne ganske vist ikke gik til Grunde, men dog brighter ikke kunden vokse. It is visible, at which it is not var Tilfældet, idet Bacterierne vare dræbte i alle de Glas, hvori de ikke voksede.

Jeg har desuden used the Forseg til at paavise, before length Brintoverte holder sig i bouillons. Det viste sig, at selv en ubetydelig Mængde Brintoverilte kunden holde sig uforandret i broth i 4 Maaneder; baade 26/1 og 21/5 customer of the nemlig paavises Brintoverilte i No. 7, men ikke i No. 6*).

With the following 2 Forsøg har jeg endnu tydeligere end ved No. 2 paavist, at Bacterierne ere mere fintmarkende overfor Brintoverilte end Schönbeins Reagenser.

94 that has jeg endogsaa kunnet koge, uden at det dekomponerededes (see Forsøg No. 1 and 2). Desuden har jeg vistnok ikke used samme broth to de to Forsøgsrækker; den, der anvendtes til de p. 94 omtalte Forsøg, heldt som jeg har omtalt p. 76 muligvis Spor af mælkesurt Natron.

Forsøg No. 4. 29/1 Kl. 1 Em.

From Reagensglassene No. 4-9 in the forrige Forsøg for Draaber over paa Bjærgkrystalplader tilligemed en Kontroldraabe. Paa dette Tidspunkt kunde der paavises Brintoverilte i No. 7, men ikke i No. 6. Der saaedes i Draaberne med Spidsen af en Podenaal fra en 21 Timer gammel ufortyndet Kultur af Staf. pyog. aur.

For jeg saaede Bacterier i Draaberne kunde jeg paavise Brintoverilte i No. 7, men ikke i No. 6; Men allerede i No. 5 voksede Bacterierne senere ud end i Kontroldraaberne, og i No. 7 var Forsinkelsen ret betydelig.

1

Forsøg No. 5. 30/ Kl. 1 Em.

Fremgangsmaaden var den samme som ved forrige Forseg, with den Forskel, at der saaedes med Spidsen af en Podenaal fra en 43 Timer gammel, fortyndet Bouillonkultur af Stafyloc. pyog. aur. (4 store Øskener culture i 2 cm.3 broth).

Umiddelbart før Forsøgets Begyndelse gav No. 7 powerful Brintoverilte reaction, No. 6 derimod ingen reaction; desuagtet customer of the iagttage tydelig Forsinkelse af Væksten i nos. 4–7; Allerede the Brintoverilte, the foundtes i No. 8, var tilstrækkelig til at dræbe Bacterierne.

I disse to Forsøg kunde iagttage det samme som i nogle af de tidligere beskrevne Belysningsforsøg (see p. 84): naar man saaede faa Bacterier, dræbtes de lettere, end naar man saaede mange. That's what happened, when Gottstein forested it, at the bacterium column Brintoverilte. In the following Forsøg har jeg overbevist mig om, at Gottsteins lagttagelse errigtig.

3

Forsøg No. 6. 14/5 Kl. 9 Em.

Af and neutralized 1.61024% Brintoverilteopløsning fortynds 1 cm. with 9 cm.”, 49 cm. above 249 cm.: distilled Vand. Af Fortydingen 1:10 for 10 cm.' over i 2 test tubes, at Fortyndingen 1:50 and 1:250 overføres 5 cm.}. I et test tube af hvert Hold opslemmes en Osken af en agar overflade culture af B. pyocyaneus fra 25/1; Vædsken blev herved tydeligt blakket. The glass and the control glass are indicated as well as the bacteria.

All test tubes are taken from 24° to 15/5 Kl. 9 FM, because each test tube contains bouillon states, in which case the test tube bacteria are dræbte, and the correct title is given. No. 1 and 2 (1 : 10)

, titreredes med den hidtil brugte Opløsning af manganoversurt Kali, af hvilken 100 cm.3 svare til 0.5032 Gram H, 02; Fortyndingerne 1:50 and 1:250 (Nos. 3-6) titreredes med en Opløsning, af hvilken

3

3

100cm.” Svare to 0.05032 grams H, O, (1 cm.% af the oprindelige Opløsning + 9 cm.3 Vand).

The fremgaar depends on the Forsøg, on the bacterium column Brintoveriltet together with, on the selv dræbes, and on disinfection measures derfor afhænger af Bacteriernes Antal.

I de glass, hvori der ikke var Bacteria (No. 1, 3 og 5) formindskedes Indholdet af Brintoverilte kun lidt ved Henstand i 12 timers, nemlig med henholdsvis 1 milligram, 0.45 milligram og 0.146 milligram.

I de glass, the indeholdt bacteria, aftog derimod Brintoveriltet strengthens. 1 No. 2 formindskedes det med 6.79 milligrams og i No. 4 med 1.61 milligrams. Vædsken i begge this glass blev sterilized; This is what you see, with extremely strong bactericidal Virkning Brintoveriltet har, idet this forholdsvis ubetydelige Mængder formaede at dræbe den uhyre Mængde Bacterier, der høre til for at gøre henholdsvis 10 og 5 cm.: Vand blakket.

I No. 6 var Brintoveriltet (0.32 milligrams) forsvundet ligesom i No. 4, men Vadsken var ikke sterile; Because Mængde Brintoverilte har aabenbart ikke været tilstrækkelig til at dræbe Bacterierne.

At Brintoverilte special deles af Bacterier kan ligefrem se, idet the beginning in livlig Luftudvikling (Ilt) ganske kort Tid efter at Bacterierne ere ned in Opløsningen.

Since Brintoveriltets bactericide Evne altsaa ganske afhænger af Bacteriernes Antal, man kan ikke angive noget absolutely, for all Tilfælde gældende Maal for the. Most of the time, before there are a few bacteria in the area, Brintoverilte can be dræbe. For at udfinde that har jeg gjort the following Forsøg:

In about 24 timers there was a broth culture of B. coli communis filtreredes; 2 cm.% af the fortyndedes med about 30 cm.' wall; above fortes 1 cm. over i en Række test tube, the indeholdt Brintoverilte i forskellige Fortyndinggrader. Glassene stilledes i Termo.stat ved 37° i 39 Timer, hvorefter en øskenfuld fra hvert test tube førtes over i Bouillon; 48 Timer senere saa jeg efter, i hvilke bouillon glass of the var Vækst. Umiddelbart efter at have for bacterium over i Brintoveriltet used every 1 cm.3 of the fortyndede Bouillonkultur to Fremstilling af Spredningskulturer to Tælling.

The Brintoverilte, each used, var kemisk rent and heldt oprindligt 30 °. H,02; Now further omtrent ', Aars Henstandt found jeg ved titrering with the tidligere nævnte Opløsning af manganese excess Kali, at which it contains 21% H_2O_2.

In the following skema ses hvor meget Brintoverilte hvert enkelt Glas indeholdt. K betyder culture.

.

cm.3

2

No. 1 1 cm.K + 1 cm. prompt. H,O, 0.21 Gr, HO, i 2 cm.3 10.5%

Oplosning. 21 K + 1 ucontinue. H.02 + 1 cm. Vd. 0.21 gr. H_2O_2 i 3

cm.3 7% opløsning. 3 1 K + 1 ucontinue. H.02 + 3 cm.3 Vd. 0.21 gr. H_2O, i 5

4.2% Oplosning. 4 1 K + 1 H,O, 1:5 0.042 Gr. H,O,i 2 cmn.3 2.1% Opl. 5 1K+1

H,O, 1:10 0.021 Gr. H,0,i 2 cm.3 1.05% Opl. 1 K + 1 H,0, 1:25 0.0084 Gr, H, O, i 2 cm.”

0.42%

Oplosning. 7 1K + 1H,0, 1:50 0.0042 gr. H.02 i 2 cm. 0.21%

Oplosning. 8 1K+1H,O, 1:100 0.0021 Gr. H.02 i 2 cm.3 0.105%

Oplosning. 9 1K+1H.0, 1:500 0.00012 Gr. H,0,i 2 cm.3 =

0.021%

Oplesning. . 10 1 - K + 1 H.02 1:2500 0.000084 Gr. H.02 i 2 cm.3

0.0042% Oplosning. 111 K + 1 H.,0, 1:10000 0,0O0021 Gr. HO, i 2 cm.*

0.00105%. Oplosning.

h, o,

No. 12 1 cm. K + 1 cm. H,0, 1:50000 0.00C0042 Gr. H, 0, i 2 cm.

0.00021% Oplesning. 13 1K+1

1:250000 0.00000084 Gr. H, 0, i 2 cm.;

0.000042% Oplosning. 14 1 - K + 1 - H20, 1:1000000 0.00000021 Gr. H, 0, i 2 cm.;

0.0000105% Oplosning. 15 1K + 1H,0, 1:5000000 = 0.000000042 Gr. H, 0, i 2 cm.

0.0000021% Oplosring.

Results at Tællingen var the following:

4

Fortydingen 1:25000 includes approx. 1500 colonists, svarende til

approx. 37,500,000 bacteria il cm. Culture.

1:/4 million includes 201 colonists, svarende til

50,250,000 bacteria il cm.3 culture.

1:1 million includes 60 colonists, svarende til

60,000,000 bacteria i 1 cm.3 culture.

1 cm.3 af cultures har altsaa indeholdt about 50 million bacteria; The Antal transfers to the top of the test tube with the Brintooverilte.

Under Henstand i Termostaten holdt Brintoveriltet sig blakket i Nos. 10–15, men blevklart i Nos. 1-9; Results from Oversaaningen to frisk Bouillon var ganske tilsvarende: you see sig, at Vædsken i Nr. 1-9 var sterile, with the i Nr. 10-15 containing living bacteria.

Results from Forsøget var altsaa, at 50 million bacteria dræbtes af 0,00042 Gram H, 02, men ikke af 0,000084 Gram.

1000 bacteria dræbtes altsaa af imellem 0.00000000168 and 0.0000000084 grams H, 02, dvs omtrent 1/200000—1/125000 milligrams H, 09.

OM FORDELINGEN AF BACTERIEDRÆBENDE STRAALERI KULBUELYSET'S SPECTRUM

AF

SOPHUS BANG

I 1894 fremstillede MARSHALL WARD*) Specter dels af Sollys, dels af elektrisk Lys ved Hjælp af en Kvartsspektrograf og lod dem virke paa B. anthracis og other bacterium i Agar-Spredningskultur i Petriske Skaale, der var dækkede dels med Glas-, dels med Kvartsplader. Ved Indvirkning af 5 Timers Sollys i August eller 12 Timers elektrisk Lys fik han paa then Maade den bakteriedræbende Del af Spektret fotograferet paa Kulturerne i Form af sterile Striber. In this case, the result, at the ultra-red, red, orange and yellow rays in Virkning udøvede paa Bacterium, before the green, blue, violet and ultraviolet rays are indicated, signifi- cantly, on paa cultures. The spectrum of the electricity Lys visible in the backbone of Virkning reaches longer and in the ultraviolet end of Sollyset's spectrum, but the maximum in Virkning found it to be Tilfælde "ved ends in the blue and begyndelsen in the purple streets."

Grandchildren other Forfattere har, uden at angive nærmere Detaljer, meddelt, at de har exponeret bacteria i et spectrum; men kvantitative Bestemmelser i Spektret er, saa vidt jeg ved, ikke hidtil **) offentliggjort. De Kundskaber, you have a lot of Styrken

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*) H. MARSHALL WARD: The action of light on bacteria III. proc. R. Soc.

London. Vol. 54. 1894. **) September 1902.

af the backed up Straaler i the forskellige spectral prayers, he opnaaede ved absorption methods, der ved Hjælp af Farvefiltrer udskyder visse Dele af Spektret og derefter undersøger Virkningen af the resterende Straaler. If the method is applied to the underscore of the spectrum, som the necessary Lysfiltre loader pass, and there are greens for these Afsnits and for the rest of Tilfælde he blot nogenlunde skarpe, bliver de optics for holding vanskelig overskuelige.

For at kunne sammenligne to lige long Afsnit af samme spectrum, valgte paa et hvilketsomhelst Sted i dette, har jeg betjent mig af den Fremgangsmaade, at et lysstrærkt spectrum then the pair in Skærm med en column, the efter comfort customer for skydes long spectrum. The Lys, the passed columns, are concentrated with the lens in a bacterium culture, and the undersøgtes, before long tid the medgik and the significant dele af spectret to dræbe these bacterium.

Fig. 1 givesr en Forestilling om the used spectral apparatus, which each har constructed, idet dog Hr. ABSALON LARSEN har været mig behjælpelig med at determine the most favorable Stilling af Prismet.

L forestiller Lyskilden, and electric Kul-Buelampe paa 30 Ampère and 50 Volt; the application of the Straaler, which follows in a Vinkel paa 50° with Kullene's axis, is the same as the spectral apparatus opstilledes i en tillsvarende Vinkel med Lodlinjen. I 20 cm. Distance from Lysbuen found in bikonveks Kvartslinse (S1) with 8 cm. Brændvidde and 6 cm. diam. Bag because it was found in 5 cm. Distance from the spectroscope column (R), which is var 15 mm high and 0.5 mm wide.

bred Since the spectral line and the spectroscope are known to be built, there are many vanskeliggøre de nedenfor omtalte bolometriske Maalinger, each applied, I set for a small retlinjet column, and the var buet paa en saadan Maade, at the tiln æ rmelsesvis Bejnenserede kompning the spectral line , saa de, i al Fald for det blotte øje, syntes retlinjede. Buens Radius found jeg ved at prøve mig frem; den var i disse Forsøg omtrent 4 cm. Ved S2, 13.7 cm. bag columns foundtes en plankonveks Kvartslinse af Brændvidde 9.5 cm., Diaimeter 3 cm. The ligesidede Kvartsprisme P var 3 cm. højt; dets brydende Kant var lodret paa Kvartsens optic axis, saa at Straalerne løb mere eller mind parallelt med denne. 30 cm. bag

Ved av, ag

Prismets Omdrejningsakse var Skærmen a, opstillet paa den med Millimetermaalestok og Nonius forsynede Slæde MN, the customer forskydes med Mikrometerskruen B. Umiddelbart foran den 2mm width, 25 mm høje column R, found the plankonvekse Kvartslinse S, af Brændvidde 5 cm., Diameter 3 cm. Ved Ko opstilledes en Overfladekultur *), the tilberedtes ved at hælde nogle Draaber Prodigiosuskultur paa Overfladen af stivnet Næringsagar i en Petris Skaal, som derpaa stilledes paa Kant, indtil den overflødige Kulturvæske var løbet af.

a, he proposes sværtede Skærme, the holder uvedkommende Lys borte.

The reason for this is that Lysbølgers stronger Brydning then the spectrum and the same device further in Linje som mn, hvis Beliggen. hed Mr. ABSALON Larsen has været saa venlig at udregne for mig. It is necessary to attach bacterial cultures in a similar way to the street, to open Belysningen to cultures, to see all of the larger and to arrange small besværliggøres. Each has the foretrukket at foretage Undersøgelserne with Skærmen a, still omtrent lodret paa Straaleretningen, som vist paa figures. Herved taber Spectra Del i Skarphed, og det bliver vanskeligt at angive Bølgebredderne med fuldkommen Nejagtighed. To the format for nærværende Arbejde he Skarpheden immedilertid tilstrækkelig, og the samme gælder Bestemmelsen af Belgebreddernes Beliggenhed, som Hr. ABSALON LARSEN has udraine med tilnærmet Nøjagtighed, saa at man kan orientere sig i enhver Del af Spektret, uden dog at de nedenfor angivne Bølgebredder tør gøre Fordring paa mere end omtrentlig Rigtighed.

Naar and bestt Del af Spektret ønskedes undersøgt, forskod man, ved Hjælp af Skruen B, columns R, indtil den sig paa vedkommende Sted af Spektret. Ved Samlelinsen S, then there are some Overfladen af Kulluren K et c. 1.5mm disturbs Billede af Buelyset. Naar R, located sig i the synlige Del af spectrum, see the images sig paa Overfladekulturen som en strærkt lysende Plet af vecoming spectral color; i den ultraviolet Del kan dets Beliggenhed, der er er nærmere ved Ry, found ved Hjælp af uranium glass, the fluorescerer under Indvirkning af ultraviolet Lys. Et

*) Se S. Bang: Om Lysets Virkninger paa Mikrober II. En forbedret Under

sogelsesmethod. Medd. Fra Finsens med. Lys Institute IV. p. 85.

Other Bevis for, at Apparatets Indstilling har været correctly, faar man eventuelt Dagen efter Belysningen ved at se Billedet saavel af Krateret som af Spidsen af the negative kul som skarpt begrænsede sterile plates paa Overfladekulturen. - Som zero point for Udmaalingen af det Sted af Spektret, before columns R, to enhver Tid found sig, valgte jeg Grænsen mellem Rødt og Ultrarødt, the med stor Skarphed viser sig ved K som en begyndende, resp. forsvindende rod Plet. Fra dette zero point rains havde the synlige Del af Spektret en Længde af c. 15mm, the ultraviolet del paa uranium glass af 57mm (see Fig. 2).*)

I Table I finds the results of the synlige Del af Spektret anstillede Forsøg. De lodrette Kolonner, mærkede 0-2, 2-4 n. S v. Angiver columns Ro's distance from Grænsen mellem Rødt og Ultrarødt, saledes at 0--2 betyder, at columns a border stod lige paa dane Grænse, dens anden rim 2 mm inde i the synlige spectrum: i Stillingen 2-4 var columns forflyttet sin egen Width (2 mm) from the first Stilling in the synlige spectrum osv Stillingen 14-16 there are transitions between violet and ultraviolet. I de grande Rubrikker betyder 0, at der ingen Lysvirkning blev synlig, + at der saas en tydelig steril Plet paa det belyste Sted. Man ser saaledes f. Eks., at ved 1/2 minutes Belysningstid er der gjort 4 Forsøg; i de 3 Stillinger: 14-16, 16-18 and 18-20 millimeters from Ultrarødt kom der ingen Virkning; and Trin longer ad i the ultraviolet, namely in stillings 20-22, come the derimod Virkning. - Paa ganske tilsvarende Maade indicated table II Forsøgsresultaterne in den ydre ultraviolet Del af Spektret, idet dog columns 18-20 and 20-22 he falls for begge tables, men med forskellige Belysningstider, idet table II gaar ned til reached at least Belysningstider, svarende til Lysets stronger Virkning i det ydre ultraviolet prayer. The same vandrette Række optegnede Forsøgsresultater he gjort uden Forandring in Apparatets Opstilling og med en og samme Overfladekultur, brought forward the unkelte Forsøgs

*) In the case of each sætter Grænsen for the synlige spectrum in Nærheden at 350,

medens WIDMARK (Om Gränsen för the synliga spectrum, Kgl. Ventensk. Ak. Förh. Maj 1897) sætter den ved gennemsnitlig 385, saa skyldes denne Uoverensstemmelse formally den Omstændighed, at det af mig applied Lys var ualmindelig intensified; uden collecting lenses S, customer Lyset ikke ses longer end til c. at 380.

tid

from Grænsen mellem Redt and Ultraredt. Belysnings- Anvendt spectral prayer, indicated ved Afstanden (i mm.)

O betyder: ingen Lysvirkning; + betyder Lysdrab (sterilized Pieti,

O

O

10-12

Forsøgstable I

+

++++++++++++otoo

0

12-14

+

+

+

oooo++++++o++

O

14-16

o+

Note For at bestmme noere, before i Rummet 18-20 the strong Stigning af curve finder Sted, foretoges desuden the following Forseg: 1) 2 Min drab 2) 4 min. Belysning gav negative result in Rummet 17-19. 3) 8 min. Belysning gav negative result in Rummet 17--19.

Forsøgstab II.

Anvendt spectral prayer, indicated ved Afstanden (i mm.) fra Grænsen

Mellem Rodt and Ultrarodt.

(betyder: ingen Lysvirkning; + betyder: Lysdrab (steriliseret Plet).

Fejlgrænse, ifølge talrige Kontrolforsøg, bliver højest 5%. Ved en ny Opstilling af Apparatet kan Fejlgrænsen for the lower Forsøg undertiden blive reaches større (20-30°%), idet the kræves meget stor Agtpaagivenhed for at faa Spektret then nøgtig paa samme Sted hver Gang Herved forklares enkelte afvigende Forsøg (f. Eks . det andet 10 minutes Forsøg paa Table I), before that, som man ser, har gentaget all vigtigere Forsøg.

From this to the table, there has been constructed a high-level curve (Fig. 2), before the calculation has been made as to the abscisse, Lyset's bacteria-driving force and the significant values of the spectrum as the ordinate. Herved faas curves ABCDE.

Curves begin at Pladshensyn for 50 minutes; men, som det ses af Table I, he en Belysning paa 2 timers in the red and gule Del af Spektret uden Virkning; first i den greenblaa Del faas Virkning ved 2 Timers Belysning. Herfra stiger curves meget stejlt; men said MARSHALL WARD som old found, at the maximum laa paa Overgangen mellem Violet og Ultraviolet, find each her (ved B) kun et second maximum, with the highest stigning af curves lighter temmelig reached and in the Ultraviolette (DE); og medens man hidtil kun har haft reason til at antage en jævn Stigning af curves from Violet mere eller mindre reached ud i det Ultraviolette, har det ved nærværende Undersøgelser vist sig, at der finds to Maksima. The first, "indre" Maximum (ved B paa Fig. 2) ligger i Egnen af 2 360—340; her dræbtes Bacterierne paa 8 til 10 minutes; men derefter folger, i Egnen mellem 2. 300 og 2 330 en skarpt begrænset og betydelig Sænkning af curves (from C, Fig. 2), idet 32 min Stejl Stigning, the fører til det andet, "ydre Maximum, the daily rummet mellem 2 300 and 2. 200, with the top point ikke reached from à 250, before bacteria dræbtes allerede ved 2 seconds Belysning. Dette ydre Maximum viser sig paa Fig 2 som en vandret Linje mellem D og E; naar man afsætter det i en Maalestok, the tillader at skelne Geländetheder i Curves Forløb, presenter the sig som paa Fig. 3, before Tidsordinaterne he afsatte i 7., Gange større Maalestok end paa Fig. 2 .Curves i Fig. 3 he constructed

30!

80

351

60

401

40

45L

120

10

200

R...V

ultra violet.

Fig. 2. Forneden the spectret ved Hjælp af Spectrallinier afsat i samme Størrelse, som det havde i Apparatet. RV he the synlige Del af spectrum (R = rødt, V violet). Tallene forneden angiver altsaa Bølgebredderne. Tallene foroven angiver in millimeter distance from Grænsen af Ultrarødt. Tallene til venstre angiver Drabstiden i Minute; Tallene to high Galvanometerudslagene ved Energimaalingen.

ABCDE drab curves. - P QST energy curves.

after Table 2; de paa denne Tabel opførte Forsøg vilde dog ikke være tilstrækkelige til med Sikkerhed at fastslaa curves form; Men de støttes ved en anden Række Forsøg, before each stedet for Skærmen a, (Fig. 1) has an bragt in Overfladekultur paa Slæden MIN og derved, ligesom i MARSHALL Ward's Forsøg, offers spectrum direct paa cultures. The baking results from the spectrum of photographs herved in Løbet from 3—10 minutes paa cultures in the form of helt or delvis sterile zones, saaledes som skematisk fremstillet i Fig. 4, before the større or mind Tæthed af de lodrette Streger foroven antyder den større or mind Degree af Sterilitet, the opnaaedes i vedcoming spectral prayer. Dette Forsøg, som each har genetaget henved et halvt hundreds of moves with the same result, see, at curves paa Fig. 3 errigtig, hvad forms angaar. Dog vil man ved Bedømmelsen af then Form days Hensyn til, at Spektret he then ved Hjælp af et Kvartsprisme. Since Kvartsen's dispersion is constant and strengthens effects, the longer it gets longer and in the ultraviolet, the better there is to the visible Antal Bølgebredder greater spectral line

R...V

ultra violet.

Spectrum photographs in overload culture. Taetheden af Stregerne

other degrees of the opnaaede sterility.

disturb Som man ser paa Fig. 2-4, indtager f. Eks de 25 Bølgebredder mellem 200 and 225 et større Rum end de 300 Bølgebredder mellem 300 and 600. Reduceret til et normal spectrum vilde derfor den ydre Del af Curves faa and forholdsvis reaches større Værdi At the end of the day, you can hold on to a number of rings that compensate for the spectrum at least in the ultraviolet end. In nøjagtig Udregning af this Forhold har jeg ikke foretaget, because the ikke forekom mig lønnende paa Undersøgelsernes nuværende point of view, saa meget not som curve shape kun har absolutely gyldighed for the best Slags Lys, hvormed Forsøgene he stillede, og bl. a. he til en vis Grad afhængig af Kullenes Kvalitet o. lign. Each can derfor further saa meget, at the Overvægt det ydre Maximum viser over det indre, vil være endnu større i et normal spectrum. I Kvartsspektret found Drabstiden i det indre Maximum i Egnen af 8 Minutter, naar den i det ydre Maximum var c. 2 seconds; For holdet mellem the bakteriedræbende Virkning i de to Maksima var altsaa som 1:240. Sætter one den bakteriedræbende Virkning i Egnen om 2 450 til 1, blev den i det indre Maximum = 15, i det ydre = 3600. This valley, særlig det sidste, vilde i Normalspektret være betydelig større, og man kan altsaa drage den Slutning, At the baking dræbende Virkning i the ydre maximum he at least 2-300 gears stronger at the end of the other maximum, and at least 3-4000 gears stronger at the end in the middle of the blue Del af spectrum. *)

Aarsage to this ejendommelige Maksima i Ultraviolet kunden paa Forhaand tænkes at være den, at Energifordelingen i Buelysets Spektrum visit tilsvarende Maksima. Hvis den Straalemængde, som udgaar fra Buelyset, paa this Steder af Spektret var større end andetsteds, vilde det være let forstaaeligt, at the bakteriedræbende Kraft forholder sig paa samme Maade. For at undersøge dette Spørgsmaal nærmere, har jeg med Hr. ABSALON LARSENS velvillige Bistand foretaget bolometriske Maalinger in the applied spectrum, idet the dog, is required for et appropriate bolometer used in lineær, c. 1mm bred Thermosojle paa det Sted, in front of ellers columns R, located sig. Idet Straalernte rammed the sværtede Thermosojle, omsattes Størstedelen af its Energi til elektrisk Strom, the maaltes i et Galvanometer af the Folsomhed, at 1 Skalainddeling svarede

*) Efter at nærværende Undersøgelser var ends, has Dr. Bie i sin Bog: Om Lysets

Virkning paa Bacterier (Doktordisputats, Kbh. 1903 eller disse Meddelelser VII og IX) indicated Virkningen af de Straaler, the passerer Kvarts, to 12 gears stronger end Virkningen af de Straaler, the kan gennemtrænge glass. The lave Tal staar kun tilsyneladende i Strid med ovenstaaende; dr Bie har bejdet med absorption methods, som han mærkelig nok mener skulde egne til bedre at maale Virkningen af the ultraviolet rays and direct undersøgelser in the spectrum. dr Bie's result he aabenbart fremkommet derved, at Glasset, som han har anvendt, har ladet en Del af de til det ydre Maksimum svarende Straaler gaa igennem sig, hvilket yderligere fremgaar af, at vedkommende Glas var permeabelt for Straaler indtil à 295, medens det ydre Maximum, som oven for omtalt, begynder allerede ved c. 300. Man ser heraf, hvor fragmentariske de ved absorption methods opnaaede Resulter kan være, og vel i rules nedvendigvis ma a være.

to 213. 10:-8 amps. Paa because Maade found it energy development i the applied spectrum that is fremstillet ved the tyndt optrukne curve PQST paa Fig. 2. Fra P til Q falder den, som rimeligt he, meget strengthens, idet fjærner sig fra de varmere" lysende Straaler hen mod de ultraviolet; i det indre Ultraviolet viser den et Maximum ved S, der i Beliggenhed nogenlunde svarer til det indre Maximum B af Drabs curves. Den indbyrdes Forskydning paa c. 1 mm, som this to Maksima viser, kan bero paa en Fejl i Opstillingen, idet the ved de primitive apparatus, the stod til Tjeneste, var umuligt at sikre sig, at Thermosejlen there are sig nøjagtig paa samme Plads som tidligere columns Rg. Det he Therefore, in the case of nærliggende Mulighed, at the indre Maximum B verkelig he et Udtryk for Buelysets større Energindhold paa the Sted af Spektret. Other ledes forholder det sig derimod med det ydre Maksimum DE. Som man he Buelysets Energicurve her (ved T) sunket til en med the used apparatus næppe maalelig Størrelse, velvety med at the bakteriedræbende Kraft naar sine højeste Værdier. Dette Forhold he saa meget renere, som the one curve Stigning omtrent sker velvety med the other curves Fald; medens energetic curves from P til T er sunken et Par Hundrede Gange i Værdi, he Drabs curves from A til DE stegen mere end 1000 Gange i Værdi. The fremgaar heraf, at Stigningen af den bakteriedræbende Kraft i det ydre Maximum skyldes specifike" Egenskaber hos de mellen 2 300 og 2. 200 liggende ultraviolet Straaler, hvad naturligvis ikke udelukker, at de mindre Svingninger curves viser mellem D og E paa Fig. 3 kan skyldes en ujævn Fordeling af energies in the Del af spectrum, ligesom curves strength Fald i Egnen af 2 200 ikke behøver at antyde, at the endnu kortere Lysbølger mangler because Virkning, eftersom that Forhold kan find a simple Forklaring derved, at omtrent ved a 200 beginning Kvartsen to absorber Størstedelen af Straalerne.

OM LYSETS INDVIRKNING PAA DYRISKE VÆV

AF

GEORGES DREYER AND HANS JANSEN

The previously reported Undersøgelser over Lysets Indvirkning paa dyriske Væv have i first Række været anstillede paa Mennesker. Talrige Forskere have given detailed descriptions of the macroscopic Forandringer, som Hud, the har været adsat for strærkt Lys, kan frembyde, og have endvidere undersøgt, hvilke Spektralstraaler dere de virksomste. (CHARCOT, DEFONTAINE, GINTRAX, MAKLAKOFF, WIDMARK, HAMMER, FINSEN or fl.).

For direct under the microscope, you can follow the ved Lys foreign Betændelse used FINSEN) from the Haletudsehalen asm Forsøgsobjekt. Han asked Haletudsen with Kroppen indpakket i vaadt Filterpapir paa et object glass and udsatte den for direct Sollys under stadig Overrisling med cold Vand. Couple of clear tidspunkter under Belysningen lagde han Halen under microscope. Paa denne Maade iagttog FINSEN the following Fænomener: Standsning af Kredsløbet, Udvidning af Kapillærerne, Udvandring af Leukocyter, Diapedese og i nogle Tilfælde en ejdommmell contraction af the røde Blodlegemer, saaledes at de blev buttede og runde. Fænomenerne started at indtræde efter 10—15 min.

The nævnte contraction af de røde Blodlegemer he ogsaa observedret af BANG?).

1) Finsen, NR: Om de kemiske Straalers skadelige Virkning paa den dyriske Organisme. Hospitalstidende No. 44, around 1893.

2) BANG, S.: Traitement du lupus par les rays lumineux concentrés, d'après la method du Dr. Finsen (de Copenhague). Congress de la Tuberculosis. Paris 1898.

status

Strangely he Lysindvirkningen paa forskjellige normal and pathologiske Væv gjort til Gjenstand for talrige histologiske Undersøgelser (WIDMARK, OGNEF, MOLLER, LEREDDE, GLEBOWSKI, PILNOFF, WANSCHER O. fl.).

After this, the result should be higher and higher, giving Lyspaavirkningen signifies the following histological causes: Udvidning on Blod- and Lymfekar, serous exudation and dermed following epitelløsning, sparse cell infiltration including bleeding and thrombosis can be found omtalt hos MOLLER').

Imod those Undersøgelser, som iøvrigt udmærke sig ved stor Omhu, kan der imidlertid rejses den Indvending, at han I nogle af sine most vigtigen Forsøg sandsynligvis har bejdet med en Blanding af Lys- og Varmevirkning. Dette fremgaar dels af, at the strax efter Belysningen af Kaninørerne fremkom Betændelsesfænomener, dels af hans egen Temperaturangivelse. Ifølge denne viste et blankt, ikke sværtet thermometer, anbragt frit i air in the Lyskegle, the benyttedes, 40°. Controlled, som we have prepared, give imidlertid the result, at et sværtet thermometer under samme Forhold viser in temperature paa 65° C., together with at et blank thermometer, omviklet med et levende Kaninøre og anbragt sammesteds in Lyskeglen, viser ca. 52° C. This temperature ere imidlertid i sig selv, uden no velvety Lysvirkning, tilstrækkelige til at fremkalde stærke Betændelsesfænomener, Forhold, der allerede ere paaviste af CohnHEIM) for fugtig Warmes Vedkommende, nemlig ved Neddypning af Kaninøren i Vand af 4°-5 Tp.-5 At imidlertid ogsaa Straalevarme af because of the temperature (52°456) outside the strong Betændelsesfænomener, endog efterfulgte af necrosis, have vi konstateret ved Forsøg paa Kaninøren.

After that before Undersøgelser i first Række have used Frøens Tunge asm Forsøgsobjekt, since skyldes dette, at man derved he istand to direct under the microscope at the following fiber in Lyspaavirkningen, som deten he met vanskeligt or saa at sige umuligt

1) M. Møller: The influence of light on the skin in a healthy and diseased state. Bibliotheca medica. Notebook. 8. 1900.

?) Lectures on general. Pathology. Vol. I. 1877. p. 203

with tilnærmelsesvis samme Sikkerhed at erkjende ved vidtrækkende histologiske Undersøgelser.

No further forsøg ere ogsaa anstillede paa Frøens Svømmehinde og mesentery including paa Haletudsehaler, som dog i Sammenligning med Frøtungen he et temmelig usikkert Forsøgsøgsobjekt, idet he often gets vanskeligt at udrede, hvilke Fænomener der skyldes Lysvirkning, og ult des hvilke der skyldes hvilke der skyldes.

The i the following mentioned Forsøg have the days Sigt paa at following Gangen i hele Lysvirkningen and dels paa at afgjøre, hvorvidt Nervesystemet have Betydning for Lysreflexens Opstaaen.

Fremgangsmaaden ved Frøtungeforsøgene var the following: Frøen urethaniseredes. Naar Bedøvelse og Kegelslaphed var indtraadt, Anbragtes Frøen i Bugleje, Tungen udspiledes paa et CohnHEIMS Tungebord, halled at the var muligt under microscope direct at iagttage Tungens Udseende, saavel for som paa et hvilket som helst Tidspunkt under og efter Belysningen.

Som rule belystes kun et begrænset Parti, c. 1/4 x '/, ctm. Stort, depending on the basis on which one works, is the same as the other Udstrækning var dakket med et double Lag Staniolpapir.

Som Lyskilde used in electric Kulbuelampe (30 Amp.; 45-50 Volt), og Lyset koncentreredes gjennem et Finsensk Koncentrationsapparat with Bjærgkrystallinser.

The positive and negative ball diameters were 2.4 and 1.5 centimeters.

Under Belysningen applied Tungen i Lyskeglen nedenfor Brændpunktt, before that diameter var approx. 1.6 cm.

Varmevirkningen udelukkedes ved Overrisling with en 0.700 Kogsaltopløsning (Tp. 12-14).

At that point Fremgangsmaade var muligt at hindre Varmevirkning, fremgaar af the following Kontrolforsøg.

1) In the case of exposure to ultraviolet rays, such as the indskødes and glass Lysfilter with 5% Nikkelsulfatsopløsning, indtraadte ingen Lysvirkning or other paaviselige Forandringer, selv from Belysningen fortsattes i Tider (1/2-1 Time), on større Varighed at the end of de, i have the foreign typical Lysvirkning, to the ultraviolet Straaler ikke vare holdte tilbage.

2) Et sværtet thermometer, which is requested paa same Sted i Lyskeglen og overrisled paa Lignende Maade, viste som højeste temp. 18°, hvilket he en Varmegrad, so i sig selv ikke fremkalder paaviselige Forandringer paa Frøens forskjellige Væv.

The following description of the Vævsforandringer is said to be open to the public, rene Lysvirkninger, outside of Virkning af the Lysstraaler, som passere gjennem Bjærgkrystal.

The most common requests are as follows with the following synlige Forandringer:

Efter et par Minutes Belysning svulmede Karrene op og tegnede sig skarpt imod Omgivelserne. I the following minute blev hele the belyste parti strengthens hyperæmisk. Karinjections usually sit maximum ved 7-8 minutes Belysning. Samtidig med Hyperæmien indtraadte almindeligvis ogsaa en betydelig lokal Svulst, saaledes at the most parti hævede sig voldagigt frem paa den ellers jævne Tungeoverflade. Ved continued Belysning tiltog the ødematose Svulst og kunden saaledes dække noget over den strærke Karinjektion, saaledes at det belyste Parti sluttelig antog en mere unbestemmelig graaligrød Farve.

For the results of the analysis of foreign objects directly under the microscope, the following are included: Efter ca. dede, og Kredsløbet vart livligere. The client has hands, at and with clothing and carries and therearligt Kredsløb, yes enkelte med kapillare Staser, efter ca.

If there are longer Tids Belysning blev Karudvidningen betydeligere, saaledes at Tværarealet af de smaa overfladiske Arterier og Vener often var 4-5 Gange saa stort som før Belysningen. Samtidig with the strong cardiolatation indtraadte anden typisk and constant Forandring, is Kredsløbet blev long summers and kort efter helt standsede in de videde Kar, saaledes at the then tykke røde Thromber in all the overfladiske Kapilærer og smaa Kar, svarende til det belyste Parti.

Det maa udtrykkelig fremhæves, at these Karforandringer kun ramte de overfladiske for Lyset let tilgængelige Kar; de dybe, større Karrene together with endog Kapilærerne paa Tungens Papilside viste sig fuldstændig upaavirkede, hvilket ogsaa gjaldt Karrene i den ubelyste Del af Tungen. Det belyste Parti afgrænsede sig altid meget skarpt. Paa Grænsen mellem det belyste og det ubelyste Parti indsnævredes Karrene derfor meget brat til normal Tykkelse, og her i Grænsebetet saas derfor Kar, der vare udvidede, men endnu ikke thromboserede. Thromboseringens Indtræden is often reported every day in the morning in the following minutes.

Fortsattes Belysningen next videre in 20—30 minutes, saas foreign following Forandringer:

Plates, som i Begyndelsen vare stærkt Rode, antog efterhaanden en ejedomlig greenlig brinsort Farve, hist and her special kind Punkter and Pletter.

In line with Farveforandring af de rode Blodlegemer have vi aldrig set indtræde ved Belysning af Blod udenfor den levende Organisme. Spherical contraction af de røde Blodlegemer iagttoges ikke i noget Tilfælde.

Endog efter Belysninger af saa long Varighed som 30 Minutter, var det ikke muligt umiddelbart efter Belysningens Ophør at paavise Udvandring af hvide Blodlegemer.

Paa samme Maade som foran beskrevet stillede forheldene sig ogsaa, to Frømesenteriet benyttedes til Forsøg.

De faa i Tungen tilstedeværende Pigmentceller forbleve under Belysningen enten uforandrede eller bredte sig ud.

Denne Udbredning af Pigmentcellerne (5: Spredning af Pigmentkornene) kunden iagttags særlig dedigt ved Belysning af Bagfodens Svømmehinde, som derved blev kjendelig mørkere end Svømmehinden paa den ubelyste Fod, en Forandring, som ogsaa saas tydelig med blotte øjne.

I det foregaaende he kun omtalt de Forandringer, som kunden paavises under og umiddelbart efter Belysningens Ophør. Processes are followed by the following timers and syntes at have there is a maximum of 24 timers. Allerede 48 Timer efter Belysningen var Reparationsarbejdet i fuld Gang, ja, ved kortvarige Belysninger kunden Fænomenerne helt have tabt sig paa dette Tidspunkt.

It may derfor fremhæves, at reactions Indtræden og Forleb her hos Frøen he adskilliger faster end Hudreflexen hos Mennesker og warm bloody Dyr, before fluxions he først synlig Timer efter Belysningen og endog kan bruge Dage om Maximum.

24 Timers are shown in the detailed microscopes on the results often carried out, the ødematose infiltration as rule var tiltaget, and Vævet som follow heraf mere uigjennemsigtigt. the saas

Now there are rules in the ring Mængde udvandrede hvide Blodlegemer, hvorimod Randstillingen often var meget tydelig and karakteristick. Emigration from Hvide Blodlegemer found kun Sted fra de dybere, noget udvidede, men no thromboserede Kar. Dette iagttoges direct og Fremgik ogsaa tydeligt af the histologiske Undersøgelse af belyste Frøtunger og Kanineren.

Fremdeles var Antallet af røde Thromber oftenest noget forøget the following day. The red Blodlegemer i Thromberne were mere or otherwise henfaldne and sammenklumpede and had for andret Farve.

The founds iøvrigt stedse smaa Blødninger (per diapedesin), som dog undertiden ware saa store, at de customer ses med blotte øjne.

48 Timer after Belysningen var the ødematose infiltration sædvanligvis strengthens aftaget eller helt forsvunden, og before the før var thromber, var Kredsløbet atter starts when i go. Selv from Kredsløbet atter var retableret, holdt Karrene sig imidlertid udvidede. Dette stemmer goes with the AF FINSEN) gjorte og af Møller confirms the lagtagtangelse hos Mennesket, at Karudvidningen he varig, idet belyste Steder af Huden blive særlig røde ved Frottering endog 5-6 Maaneder efter at Belysningen har fundet Sted.

In the case of restitution processes, the following bills are often given. The red thrombus, som til at the beginning with helt fyldte Karrene, skiftede efterhaanden Farve, og de for Størstedelen destroy red blodlegemer and thrombe masser fortæredes tilsyneladende lidt efter lidt af de hvide Blodlegemer. One knows i ethvert Tilfælde often, saavel i som udenfor Karrene, der havde været Sæde for Thrombedannelse, se hvide Blodlegemer, indeheldende gulligrøde eller brune grain, som sikkert vare Rester af røde Blodlegemer. Blodet i de omgivende and dybere Kar, before Kredsløbet var uforstyrret, pumpedes uafbrudt ind imod de forannævnte hvide thrombelignende Masser, hvorved disse lidt efter lidt løsnedes og førtes bort med Blodstrømmen, og saaledes retableredes Kredsløbet lidt efter lidt fuldstædigt.

1) NR Finsen: Nye Undersøgelser over Lysets Indvirkning paa Huden. Meddelelser from Finsens med. Lys institute. Issues I. 1899. p. 18

Ogsaa i de Tilfælde, before Belysningen havde været saa inters, at Thrombemasserne havde antaget en brunsort Farve, afblegedes this i Løbet af the following Day gjennem forskjellige Farveovergange (grønligbrune til grønlige) og resorbedes iøvrigt paa tilsvarende Masade sovet tilsvarende.

Ved observations 3 days after Belysningen var den ødematese infiltration svunden, Kredsløbet for Størstedelen eller endog helt restitueret. The best Parti customer dog endnu være markeret ved talrige fine Ecchymoser, som skyldtes Klumper af henfaldne røce Blodlegemer, Resterne fra de smaa Bledninger per diapedesin.

Ved de særlig langvarige Belysninger (1/2 Time) var der endru 3 Day efter kjendelig Svulst af the belyste Parti, men i saa Fau skyldtes den mere den paa dette Tidspunkt nogenlunde rigige Ophobning af udvandrede hvide Blodlegemer end den ødematose infiltration.

4-6 Dage efter Belysningen frembød en Frøtunge, som havde været Sæde for de i det foregaaende beskrevne Forandringer, so. often atter ganske normal forhold, bortset fra en eventuel tilbage blivende Karudvidning.

Gaa vi dernæst over the Omtalen af vore Forsøg paa Haletudser, var Forsøgsanordningen the following:

1 or under 2 Haletudser requested i et with Vand fylus cylindrisk chamber with Kvartsvindue i begge Ender. Kamrets Længde var about 2 cm. Above diameters 0.8 centimeters. Ilttilførslen sikredes ved et fint Rør. If the arrangement is open, at Haletudserne under Belysningen customer shall be free of the order, and mekanisk Beskadigelse udelukkedes, saa vidt som dette i det he days he muligt ved dette sarte Forsøgsøgsobjekt. It is requested next to the same Sted Lyskeglen, that from Frøtungeforsøgene, and overflows under Belysningen with cold vand. For at muliggjøre en skaansom Observation efter Belysningen, bedøvede vi Haletudsen med Æther.

Umiddelbart efter en Belysning paa 20 minutes outside Haletudsehalen the following billede: Udspiling and thrombosis ring af together with lige overfladiske Kapilærer og Kar together with Udbredning af pigment cellerne. There are known to be Udvandring af Leukiniter medens Randstillingen derimod var ret fremtrædende. Rundagtig contraction af de røde blodlegemer iagttoges brighter ikke her. The following day gik repairs are scheduled for sig, and the 4th and 6th day after Belysningen var Kredsløbet atter normalt, but the sporedes dog often endnu nogen Karudvidning.

If it is foreseen Forsøg indtræder halledes de ved Lyspaavirkningen foreign Vævsforandringer in the following Rækkefølge:

First comes cardiolation and hermed the following hyperæmi, the most serious serious infiltration including thrombosis ring on the overfladiske capillaries and lesser Kar Sin Begyndelse og vil almindeligvis være tilendebragt i Løbet af ca. en Uge.

Hovedejendommelighederne ved the her beskrevne Lysvirkning he saaledes the overfladiske Sæde and the overorderly mild Forløb.

Slow skulle vi dernæst omtale nogle Forsøg, som we have prepared paa Kaniner og Frøer for at afgjøre, om Overskæring af sympatiske, vasomotoriske eller sensitive Nervetraade have nogen paaviselig Indvirkning paa Lysreflexens Indtræden og Forløb.

Fremgangsmaaden ved Kaninforsøgene var following.

The used and somewhat stronger Lys end ved Frøtungebelysnerne, namely the concentrated Lys fra en Kulbuelampe, which burned with 70 amps and 55 volts, he used the same Lys styrke, som the ved lupus treatment used.

The benyttedes stedse hvide Kaniner. Under ether anesthesia foretoges Gjennemskæring af N. sympaticus paa den ene side af Halsen, henholdsvis 8, 4, 2, 1 day and umiddelbart for Belysningen found Sted. Under Belysningen anbragtes Øret inellem 2 planparallelle, vandgjennemrislede Bjærgkrystaltrykglas, presented the opnaaedes in suitable Ischæmisering og Afkøling.

Hvert Øre belystes 2 Steder, henholdsvis 10 and 30 minutes, with the following result.

Allerede 7 Timer efter Belysningen iagttoges constant tydelig Hyperæmi af det Øre, hvis Sympaticustraade vare overskaarne, medens der endnu ikke var den ringeste Virkning at spore paa det Øre, der svarede til den uoverskaarne Sympaticus. The following Day var Hyperæmien strengthens tiltaget, ligesom der ogsaa var stærk infiltration paa det Øre, der svarede til Nerveoverskæringen, medens der kun sporedes en ringe Hyperæmi af detnormal Øre. Denne Forskel traadte som rule strongest frem ved kortvarige Belysninger, i saa Tilfælde saas nemlig en kraftig Lysreflex paa det Øre, der svarede til Sympaticusoverskæringen, medens Kontroløret næppe frembød nogen synlig Paavirkning.

I de Tilfælde, before Øren frembed reaction, var Forskellen most udtalt de første Dage og udlignedes efterhaanden næsten fuldstænglich, saa at deres Udseende i 2den og 3die Uge var nærmest ens. Udhelingen indtraadte dog altid ca. en Uge tidligere paa det Øre, before Nerveoverskæringen havde fundet Sted, end paa Kontroløret.

After that, the first known Øret and the following forecast for Overskæringen on N. sympaticus, then all the same results as in the foreseeable Forsøg, before Overskæringen found Sted paa forkjellige Tidspunkter for Belysningen.

Lighing results, som de her for Lysvirkningens Vedkommende opnaaede, ere beskrevne for Varmevirkningens Vedkommende af BUNZEL).

Han found the room, at the betændelsesaitige Fænomener, the fremkaldes ved Neddypning af et Kaninøre i Vand af 53° C., indfandt sig reached tidligere og var mere fremtrædende paa det Øre, hvis sympatiske Traade vare overskaarne.

Som Aarsag hertil angav han de ved Sympaticusoverskæringen fremkaldte trofiske Forstyrrelser.

At the Lysvirkningen næppe he muligt at clear the foreseen reaction from trofiske Anomalier, men reaches snarere ved the foreseen Blodtilstrømning and Karfyldning on det Øre, hvis sympatiske Traade ere overskaarne, fremgaar af the following Forsøg. Saafremt bathe N. sympaticus and N. vagus paa samme side bleve

1) Bunzel: On the influence of the vasomotor and sensory nerves on the inflammation of the rabbit ear caused by scalding 0. sv

Archives of Experimental Pathology and Pharmacology. Vol. 37. 1896. p. 445.

overskaarne, og dernæst foretoges Belysning af begge Oren, indtraadte lysreactions nemlig lige swift paa begge Øren.

Paa Frøer foretoges ogsaa nogle faa Belysningsforsøg efter forudgaaende Overskæring af N. glossopharyngeus og other pulmonary nerves; ogsaa her indtraadte lyse reactions faster paa the Tungehalvdel, before Nervetraadene vare overskaarne.

OM BOGHVEDE EXANTHEMETS

PATHOGENESIS

AF

GUNNI BUSCK.

Den zoo-pathologiske Tilstand, the efter en af de ætiologiske Factorer, som ligger til reason for den, gaar under Navnet "Boghvedesygdommen", har længe været kendt og finds omtalt i det 18. Aarhundredes literature. Det drejer sig om en blæreformet Hudbetændelse, the optræder hos Kvæg (Køer, Faar, Svin etc.), som fodres med Boghvede, and som velvety staar udsat for Dagslysets Paavirkning. Sygdommen omtales udførligt af DAMMAN'), som henleder Opmærksomheden paa, at sort-pigmenterede Dyr ikke angribes af den, og at selv blot en Forurensning af Huden med Støv og Sveder tilstrækkelig til at forebygge Lidelsen. WEDDING ?) fremhæver, at broget Kvæg kun attacked paa de ikke pigmentered Pletter, og at Exanthemat bliver stærkere, naar Dyrene he udsat for the direct Sollys, end naar de staar i spredt Dagslys. En hvid ko, som han sværtede sort paa dene Side, fik kun Udslet paa den anden og Lysets uhindrede Adgang til Hudens dybere Lag synes altsaa at være en nødvendig Betingelse for Exanthemets Fremkomst. VIRCHOW) has confirmed WEDDING's Angivelser, og han henviser til, at allerede Darwin has omtalt Boghvedefodringens ætiologiske Betydning for denne Sygdom.

) DAMMAN: Health care of agricultural domestic mammals. Berlin, 1883, pag. 411-414. 2) WEDDING: Journal of Ethnology. Vol. XIX, 1887, pag. 67. 3) Virchow: ibid.

WEDDING formoder, at Sollyset indeholder nogle hidtil ukendte, used Straaler, og at these i Forening med en toxic Substans i Boghveden fremkalder Exanthemet. For at clear dettes Fremkomst he der dog næppe nogen Grund til at days Tilstedeværelsen af saadanne ukendte Straaler i Sollyset saalænge det ikke he udelukket, at vi staar overfor en Virkning af de Straalearter, vi kender.

I sin first Afhandling om Dagslysets Indflydelse paa Koppesygdommens Forløb sammenstiller FINSEN 1) because Hudens pathologiske Følsomhed overfor Lys hos boghvedefodret Kvæg med the, who finds hos Koppepatienter. Han writes: Vis sér altsaa, at Huden kan bringes i en saa følsom Tilstand, at selv en ringe Lysmængde, som under normal Forhold he uden nogensomhelst synlig Virkning, bliver i Stand til at fremkalde endogsaa betydelige Affektioner.

As you know, TAPPEINER 1) and Hans Elever see that you can make sensitive microorganisms and risk Væv overfor Lys ved Hjælp on suspect fluorescent substances. I 'm the first to try these undersøgelser berører TAPPEINER ogsaa Spørgsmaalet om Boghvede-Exanthemat, idet han skriver, at Fremkomsten af denne Hudbetændelse maaske kan bero paa Optagelsen

resp. Dannelsen on fluorescent substances from Foderet.

When JACOBSEN'S) and DREYER'S ") Forsøg fremgaar det, at coldblodige Dyr (Frøer) ved injection of eosin or erythrosin loader sig sensitisere in total, saaledes at Vævsdele, till hevilke the sensitiserende Stof maa være ført gennem Blodkarsystemet, viser sig følsjere overfor Lys end normalt. DREYER sees endvidere, at one ved erythrosine injection locally can sensibilisere Hudens Væv hos varmblodige Dyr (Kaniner, Mennesker). saaledes treated Mus. Han er tilbøjelig til at opfatte Fænomenet som en Forbrænding, fremkaldt ved the stronger absorption af Sollysets Varmestraaler. Denne Forklaring he dog sikkert rustic; den modbevises allerede af den Kendsgerning, at Sollyset ikke fremkalder necrosis -- eller endog blot lettere Forbrændingsfænomener --- af sort-pigmenterede eller artcht sortfarvede Legemsdele, skønt Absorptionen af Varmestraalerne her erlangent stronger end i de med Eosin rødfarvede Øren, som i change Tilfælde loader in stor Mængde røde Straaler passere.

1) Finsen: Om de kemiske Straalers skadelige Virkning paa the dyriske Orga

nisme. Hospitalstidende, Nov. 1893.) TAPPEINER: Munich med. Weekly publication, Jan. 2, 1900 and Nov. 5, 1901. 3) JACOBSEN: Journal for Biology, Vol. 41. 1901. 4) DREYER: Meddelelser fra Finsens med. Lys Institute, VII. 1903, pag. 110. 5) Raab: Journal of Biology, Vol. 44. 1902.

The reason for this is sandsynligere, at necrosis - there are som ogsaa DREYER") antager det -- skyldes en direct Lysvirkning, which he muliggjort ved in Sensitizing af Vævet overfor de ellers lidet virksomme grønne Straaler.

Sammenholder man nu hermed Boghvede-Exanthemets kliniske Lighed med de Betændelser, som Lysets kemiske Straaler formaar at fremkalde i normal Hud including the ejendommelige Forhold, at the Fremkomst betinges af the following tre etiological factors: Boghvedefodring, Lys og pigmentfri Hud, saa ligger det nær at Opfatte Boghvede-Exanthemat som en Lysbetændelse, fremkaldt af ellers uskadelige Straaler in den ved Boghvedefodring sensibilisered Hud. Ud fra dette Synspunkt forekom det mig, at det vilde have sin interest at faa undersøgt, hvorvidt Boghvedeplanten indeholder et for the ejendommeligt Stof med sensitiserende Egenskaber - et Stof, som oldsaa ikke skulde finds i other af de til Fodring almindelig applied Planter.

There reaches the overvejende Del af de Stoffer, med hvilke det hidtil er lykkedes at sensibilisere dyrisk Væv, er fluorescerende Farvestoffer, laa det nær at antage, at det ogsaa i dette Tilfælde maatte dreje sig om et saadant. Director for the pharmaceutiske Læreanstalt in København, Professor E. KOEFOED, visits the store Venlighed paa min Opfordring at foretage en kemisk Analyze af tørret Boghvede, for om muligt at paavise Tilstedeværelsen af Stof med this Egenskaber – og hans Undersøgelser førte til et positive result . Professor KOEFOED has given no detailed descriptions of the fluorescent Farvestof, which he has given to Navnet: "Fluorophyl".

,, Sølvboghveden (Fagopyrum esculentum argenteum) indeholder

1) DREYER: I. c.

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and Chlorophyllvestof, hvis Opløsninger viser en stærk rod Fluorescens, og for hvilket det ovenstaaende Navn foreslaas.

The strangers ved at udtrække den tørrede Urt (afmejet under dens Blomstring) med Vinaand. The green tincture is taken in Times Tid med fint pulveriseret Blyilte, after which he tilsat lidt af en vandig Opløsning af eddikesurt Blyilte. After that, filtering is done by the other saa means Blysukkeropløsning, at Vædsken has and rings Blyindhold. Bundfaldet frafiltreres, og Filtratet fældes med sit half the volume of Vand, taken from the Chlorophyl udfældes. He Udfældningen heraf ikke fuldstændig, maa the tilsættes en Smule Blysukkeropløsning endnu. After filtering you have in Vædske, so that you see a strong red fluorescence; Men require fluorophyl indeholder den lidt af et rødt, ikke fluorescerende Farvestof, som he noget lettere opløseligt i fortyndet Vinaand. Rensning herfra sker ved at afdistillere Halvdelen af Vædskens area. He derefter endnu rød, men the fluorescent Forbinderlse har udskilt sig som brune Fnug, the frafiltreres. Paa Filtret udvadskes Stoffet med Vand for at fjerne en ringe Mængde vedhængende Blysalt, hvorpaa Filtret terres og extraheres med Vinaand i et Soxhlet's Apparatus. The vinaandige Opløsning inddampes til Tørhed, og Remanensen opløses i Svovlkulstof; With filtering on Svovlkulstofopløsningen one can fjerne et rødt, no fluorescent Farvestof, som formentlig he is identical with the oven for nævnte. Ved Afdampning af Svovlkulstoffet bliver Fluorophylet tilbage som en voxblød Masse, som i tynde Lager he gulgrøn. Above 110° for and above the room, with fluorescence on the Opløsninger taber sig mere og mere. It is dissolved in Vand, dissolved in Vinaand, Ether, Chloroform, Benzene and Svovlkulstof.

Af 500 grams tørret Sølvboghvede customer of the customer vindes 1.5 grams af Forbindelsen; almindelig Boghvede indeholder ogsaa Fluorophyl, men i reached at least Mængde.

Fluorophyl ligner efter det ovenstaaende i ikke ringe degree Chlorophyllanet, som af HOPPE he fremstillet af Græs. At de to Stoffer dog ikke he identiske, fremgaar dels deraf, at hvis man treater Græs paa den ovenfor beskrevne Maade, viser Filtratet fra Chlorophylbundfaldet ingen Fluorescens, saa at Chlorophylanet maa fældes sammen med Chlorophyllet dels deraf, at Fluorophyllets Askeindhold he gets lavere end det , such as HOPPE and

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GAUTIER found i chlorophyllan, namely 1.75%. fluorophyl frem

% breastfeeds paa the specified Maade giver kun 0.6% Aske, the bestaar af phosphate."

The he didtil kun fremstillet saa smaa Mængder Fluorophyl, at systematic Undersøgelser over the sensitizing Evne ikke har kunnet udføres; Men allerede Paavisningen af, at Boghvede indeholder et fluorescerende Farvestof, som ikke finds hos other almindelige Foderplanter, tør maaske tage til Indtægt for the Hypotheses Rigtighed, at Boghvede-Exanthemet skyldes en direct Virkning af Lyset paa den sensitized Hud, og at det altsaa maa Opfattes som en lysreaction, the ikke he væsensforskellig fra den, som i Menneskets Pathologie kendes under Navnet Erythema solare.

VIRKNINGEN AF CONCENTRERET ELECTRIC BUELYS PAA CHYMOSIN, CHYMOSINOGEN

OG ANTICHYMOSIN.

AF

SIGVAL SCHMIDT NIELSEN.

For forestry on the mangeartede Virkning Lyset og da navnlig det concentrated elektriske Buelys udøver paa levende Organismer, he det naturligvis af stor Betydning at vide, om det udøver nogen kemisk Indflydelse paa Æggehvidestoffe eller de øother protoplasma stocks.

Skal man gjøre sig noget Haab om ad denne Vei at solve de biochemiske Problemer, der Forefalder i Lysbiologien. Maa man selvsaid arbeide med den at least muligt denaturerede Æggehvide, or om man kan udtrykke det saa, man maa arbejde med "levende Æggehvide". Herved støder man imidlertid straks paa den Vanskelighed, at "levende Æggehvide" ikke heldes uden in Forbinderse med Enzymer.

That, the old one in the first Række maa søges brings paa det Rene, he Lysets Virkning paa de forskjellige Slags Enzymer og de med dem beslægtede substances; Kun derved har man Midler til at studere Lysets Virkning paa den native Æggehvide.

Over Lysets Virkning paa Enzymer foreligger der Undersøgelser af Downes og BLUNT, FERMI og PERNOSSI, REYNOLDS GREEN, O. EMMERLING, Weiss, H. v. TAPPEINER and kanske more, from before Viden he bleven synderlig udtømmende.

The first Undersøgelser gjordes Sommeren 1878 af Downes og BLUNT [1] ?). Kogsaltmættede Invertinopløsninger (Invertase) fremstillet ved Maceration af Gjær, said efter at have henstaaet i Sollyset 3 Uger à 1 Maaned en betydelig meget mindre Ævne til at omdanne Rørsukker i Druesukker end de tilsvarende Prøver, der var opbevarede i Mørke.

Forsøgene udførtes i Glaskar. When this is pumped air tomme, customer Forfatterne ikke paavise nogen skadelig Indvirkning, det være sig paa Invertinopløsninger eller Opløninger af organke Stoffer (Oxalsyre for Eksempel, hvilken ellers let spaltes). DOWNES and Blunt are therefore applied to the Virkningen at være in the oxidation process, which cannot foregaa uden Nærvær af Surstof.

FERMI and PERNOSSI (2] resumerer themselves sine Undersøgelser (i 1894) derhen, at Pepsin- og Trypsinopløsninger afsvækkes mere i Sollys end ved Opbevaring i Mørke I anden Forsøgsrække blev every fluidized bacterium culture belyste i Sollys i 200 Timer, with the Kontrolprøver opbevaredes i Mørke. Det viste sig, at Ævnen til at smelte Gelatine var nedsat til fra '2-", af den ubelyste Prøves.

EMMERLING [3] found (1901) at Sollyset i sin Almindelighed kun var af ringe Virkning; Often customer saaledes en skadelig Indvirkning knapt paavises (Invertin, lactase, emulsin, amylase (diastase)). En mere betydelig Indvirkning found ligeoverfor Chymosin og Maltase (Gjærudtræk!). hvilket tilskrives de methodiske Feil, navnlig i Paavisningen Bestemmelsen af Enzymmængderne Forsøgene udførtes med 1% vandige Oplosninger, tilsat Toluol i aldeles fulde Glaskar. Belysningen var 5 Day dels i spredt dels i direct Sollys.

WEISS [4] customer (i 1901) efter more Timers Belysning ikke find, at Sollyset udøvede nogen nævneværdig om overhovedet en Virkning paa de proteolytic enzymes in Maltudtræk.

V. TAPPEINER [5] og STARK [11] har nylig (i September) givest some interesting Meddelelser om Sollysets Virkning paa enzymes in Nærvær af fluorescent substances (sensitizers). Medens Solly's alene var uden Indflydelse paa Enzymopløsninger, blev disse be

') This number will be read until the literature is updated.

tydeligt svækkede, naar de indeholdt yderst smaa Mængder af visse Farvestoffe, f. Eks. eosin. (Se videre page 168).

All these undersøgelser he beheftede with the file, at which he udførte i Glaskar (Kolber, Reagensrør ol). Paa dene Side er derved ikke taget tilstrækkeligt Hensyn til at faa hele Vædsken ens gjennemlyst, hvilket ikke kan opnaaes uden i Kar med planparallelelle Vægge. Paa den anden Side har man derved afskaaret Lysets ultraviolet Dele fra at virke.

Since this does not include the Del af Lyset, the udøver nogen væsentlig kemisk Virkning, maa samlige this Forsøg om ikke af others, saa af denne Grund tillægges ringe Betydning for lysbiologiske Spørgsmaal.

The first moderately known work, the study Lysets Virkning paa Enzymer under tilstrækkelig Hensyntagen to saavel Spørgsmaalets fysikalske that dets kemiske Sider he GREEN'S [6] over dets Virkninger paa Diastasen (i 1897). Undersøgelserne, the var foranledigede ved BROWN OG Morris' [7] lagttagelse, at Planteløvets content paa diastase aftog ved stærk Belysning, viser at Lyset som Helhed har en destructive Virkning paa det diastatiske enzyme, hvad enten dette he af vegetabilsk eller animalsk Oprindelse. Ved Omtalen af mine egne Forsøg vil jeg tilbage til Detaillier af GREEN's særdeles interesting Undersøgelser. If this is the case, then, at least the ultraviolet component of the Lyset has been destroyed in Virkning, you can see the other Del af spectrum signals at have a favorable Virkning forsaavidt the Diastasens zymogen (uvirksomme Forstadium) derved customer overføres ien virksom form.

GREEN har ved sine Forsøg saavel used Sollys som Lyset fra en elektrisk Buelampe med en "Lysstyrke" af indtil 2000. For at kunne opnaa tydelige Udslag maatte han dog anvende long Belysningstider (from nogle Timer op til et helt Døgn), hvilket naturligvis saa vel rent method seet var en Ulempe, som fordi the da matte tillsættes antiseptics for at holde en bakterievirkning border

Both antiseptics and other antiseptics are usually used in the influence of enzymes "Arbeidsevne".

Ved Hjælp af de af FINSEN constructed Samleapparater, he det lykkedes at frembringe Lysvirkninger paa de forskjelligste Organismer i en Brøkdel af den Tid, det ikke koncentrerede Lys be

høver, og ved Hjælp af this one has opnaaet positive Udslag i tidligere tvivlsomme Tilfælde.

This is indicated by the fact that there is a risk of damage to the soil in Undersøgelse over Virkningen on the concentration of Lys paa enzymes. GREEN havde kun studied Diastasens Forhold to Lyset og det havde derfor ogsaa sin interest at undersøge, om de for Diastasenfundne Forhold havde Gyldighed for Enzymer i sin Helhed.

Ved generøs Velvilje fra Professor Niels R. Finsen, the still entire sit Instituts Hjælpemidler to min Disposition, og efterat each havde received et Bidrag from Fritjof Nansens Fund to Videnskabens Fremme kunden jeg Sommeren 1903 udføre endel Forsøg i omhandlede Retning. The derived fundne result shall be any of the following in corroborated external silence.

Forsøgsanordningen var hovedsagelig baseret paa Anvendelsen af concentrated elektrisk Buelys from Kulelektroder, saaledes som dette efter FINSEN used for lupus treatment. Det

The held part of the lamp with fixes the fire point, the burned with the electrode at a distance of 24 and 17 mm. under a Spænding of 50 volts with a current of 50 amps.

Lyset samledes i et Finsens Concentrationsapparat med Kvartslinser anbragt under en Vinkel af 45 Concentrationsapparatet he tidligere beskrevet her i Meddelelserne (blandt andet i IV p. 33), previously every kun skal angive, at Frontlinsens virksomme Brændvidde var 12.5 cm. Lysstyrken in the saakaldte Lysflæk, before Belysningen foretoges, can ved the trufne Anordning til at være 350 Gange større end in 1 meter distance from Elektroderne (dv S. under 45°). Other roads, the paavirker Øiet, which is the reason for this, should be "Lysstyrken" in Lyspletten, which could total approx. 1,750,000.

No information is available in this case, however, the maximum amount of material used at the end of the microbiological process; nearer to Nød kan greje sig med en enkelt Draabes Gjennemlysning, kræver de kemiske fuldt ud maalbare Mængder, omend this bliver meget mindre end vanligt, naar som her Undersøgelsen employ sig med catalyst, hvis Arbeidsholdævne ikke staar der ies direct . The vistnok paa dene Side være ønskeligt at faa den størst mulige Vædskemængde gennemlyst; Men paa den Anden side can imidlertid det concentrerede Lys velvety kun skaffes over en ret limited set Flade, modsvarende Lysplettens Størrelse. Denne can forøges ved at Belysningen fore. daily i større distance from the concentration apparatus; men velvety after lysine concentrations uforholdsmæssig meget (med Afstandens Kvadrat). Maximum af Lysvirkning erholdes the hvor Lyspletten har sin minimal Størrelse, eller savere lidt udenfor eller indenfor the point, old efter de Straaler man fortrinsvis vil have.

Smaa Kolber eller Rør lader sig ikke anvende, paa den ene Side fordi these Kar ikke tillader en ensartet Gjennemlysning; Men væsentligst fordi de ikke kan erholdes af Kvarts, uden uforholdsmæssigt Besvær. When Hensyn til, at the ultraviolet Straaler, the net top de kemisk virksomme, ikke kan passere gjennem Glas, var det en Nødvendighed, at Forsøgskarret var af Kvarts.

There were many things that happened at an event and a flat, cylinder chamber, together in a ring shape Glassskive and two plane-parallel squares. Arrangements in front of the main figure, as shown in Fig. 1 in front of the chamber (det vil sige i Belysningens Retning), Fig. 2 from Siden and Fig. 3 and Tværsnit gjennem Middle. Ved at different Tykkelsen af Glasringen (Fig. 4) customer the same Kamret heldes af ulige Størrelse; the minimally used Tykkelse var 3., mm., hvorved dets centrale Parti, der gjennemlyses, nøiagtig rummede 1 cm.? Since velvety tre Dele var

. planlebenne, var det ikke vanskeligt at fæste dem til hverandre ved Hjælp af Adhæsionen, naar den fælles Berøringsflade (Ringen!) overstrøges med et tyndt Vaselinskikt. Derved var det ogsaa muligt at day Kamret fra hverandre og rengjøre det før hvert enkelt Forsøg. The Vædske, the skulde undersøges, paafyldtes og udtoges gjennem Kanalen d ved Hjælp af en pasteursk pipette. Under Forsøgene holdtes d. omhyggelig lukket med en liden fastloddet Parafineller Voxplade. Forsøgskammeret is requested in a scale holder in an entrance for all best distance from the concentration apparatus, not limited to the Lysplettens Yderkant gik lidt udenfor dets Midtparti. Skaalholderen and dermed Forsøgskammeret var are proposed for longer periods of concentration apparatus. Under Belysningen blev Kamret overrislet med Vand, saaledes at dets temperature ikke oversteg 15—20°. Tiltrods for Lysplettens høje temperature (240) he det derfor udelukket, at man havde med en Varmevirkning at gjøre.

Foruden disse Kamre havde jeg nogle other, der var delte i to ligestore rum, derved at der i Glasringen var fastgjort et Tværstykke (ti Fig. 5). Derved var det muligt at faa gjennemlyst to Portioner og saaledes faa sammenlignbare Værdier.

The chamber that is applied to Belysningsforsøg with the stated electricity Lys or with Sollys var constructed after the same principle,

i.e.

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dog with a larger diameter (optil 8 cm.); Godstykkelsen oversteg brighter ikke her 3.2 mm. i Almindelighed var den 1.6 mm.

Tillod nu this camera and effectively Gjennemlysning? Dette Spørgsmaal, tror jeg, maa besvares med ja. Kamrene anbragtes som nævnt saaledes, at Lyspletten (Lyskeglens Tværsnit paa det Sted concerned) strakte sig lidt udenom Kamrets Inderkant. At the ved Kamrets Sammensætning her og the i edges vilde trænge sig frem nogle smaa Vaselinflækker, the vilde kaste lidt Skygge, stod jo ikke til at undgaa; Men i det store heletaget tror jeg Kamret praktiksk tallt blev fuldstændig gjennemlyst.

Ved et Forsøg blev in 24 Timer gammel filtered culture on Bac. prodigiosus belyst i 30 min. i et chamber af 3.2 mm. Tykkelse. Ved rigig Udsæd paa Næringssubstrater, look at Bouillonprøven sig sterile efter et par Døgn ved 24°, with the paa agar, gelatine, pottesskiver var come in 10-12 colonists, hvilket under Hensyntagen til Vaselinekanten, before the bactericide Straaler ikke vil trænge frem, maa ansees som et meget favorable result.

Before doing so, he requests foretoges Belysningen halls, at the same spectrum has de ledning to at virke. I other Tilfælde skulde Virkningen af the forskjellige Spektralafsnit undersøges. This is indicated on the applied absorption filter in Lyskeglen in the Forsøgskammeret and concentration apparatus. absorption filters

var parallelepipediske Kar af Klart Glas med plane-parallel Vægge (i 1 cm. distance), der fyldtes med forskjellige Vædsker, Vand, svovlsur Chininopløsning, Fuchsinopl. etc., old eftersom man vilde afskjære først de ultraviolet Straaler og next efterhaanden all under en vis Bølgebredde.

The first forsøg and further for each pair of pepsin and papyotinopløsninger. It is visible to the public, at this point the degree is paavirkedes af the concentrerede Lys; men with the smaa Mængder (1 cm.), each customer work, see the sig snart ugjørligt at faa noget sikkert

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Begreb of the internal trade Forandringers Størrelse. Saa bra de forskjellige Methoder med Fibrin, coaguleret Hønseæggehvide, Gelatine etc. i og for sig selv kan være, saa demand de dog ret betydelige Materialmængder, for at en kvantitativ Bestemmelse kan udføres. Indtil jeg havde mere Klarhed over Processens Forløb gik jeg derfor snart over til udelukkende at studere Chymosinets Forhold, dels fordi dette i form af Løbeextract var let tilgjengelig i en concentrated and holdbar Form, men væsentligst fordi Fastsættelsen af dets Coagulationsevne ligeoverfor Melk, der er en udmærket Maalestok for the relative enzyme mængde, kunde ske med meget smaa Vadskemængder.

Chymosinopløsningernes Coagulationsevne bestemtes ved Hjælp af Coagulationstiden (Løbetiden!), which vil i dette Arbejde altid sige den Tid, der ved 35–37° medgik for at coagulere 10 cm. Gjede-, respectively Komelk, about 0.1 cm.: Enzymopløsning tilsattes. Because for a longer period of time for the coagulation process, there are more timers and derovers, so it may be difficult to deal with all the frisks, because the other people have the long opbevaring between the leg temperature and there are acidities, but there are a lot of side effects. Almindelig blandet Komelk, saaledes som den nogle (4-5) timer after Melkningen received from Meierierne, see sig paa lummervarme Dage usikker, have given gik over til tillige at anvende Gjedemelk, der da melkedes lige før Forsøget igangsattes. For de fleste Rækker's Vedkommende fik jeg derved to Rækker's corresponding valley.

The other controls that are carried out in the milking process are set in the thermostats for the normal Tid, with the Coagulationsforsøgene and the Rækken cash registers, so that the Prosecutor for the Foreseeable Slutning view and the Coagulationstid ligeoverfor in the normal Chymosinopl ø sning.

For at first helt ud sammenlignbare Tal blev videre de til samme Forsøgsrække hearing Coagulationsforsøg igangsatte velvety. Arrangements can be made, at first afmaoldes 0.3 cm. of the relevant Opløsninger in their location store Reagensrør, and derefter till 10 cm.? Melk, velvety som et Sekundur igangsattentes, og Proven applied in the paa 37 ° indstilled Vandbad.

With Hensyn paa coagulation methods relatively Nojagtighed can request, at the for the right Løbetiders Vedkommende ved

1

Parallel forsøg sjælden view sig en større Uoverensstemmelse end '/4 minutes or deromkring. For Løbetider paa more timers var Noiggtigheden nogle faa Minuter.

chymosinets

Paavirkning af Lyset he dels afhængig af Intensiteten af the applied Lys og Belysningstidens Varighed, dels af the same Enzymopløsningens Concentrationsforholde.

Hvad først Lysstyrken angaar, saa udøver

Solly and that said Lys from the electric Buelamper in relative rings Indflydelse, som that very often on the following Forsøg:

Forsøg No. XL 24 July 1903 udførtes med Ostelebe excerpt from Chr. Hansen. Extract later than 4/20 (dvs 1 Del extract and 19 D. Vand) and belystes in et Kvartskammer af 1.5 mm. Tykkelse. Belysningen foretoges i straalende Solskin paa Institutet flat day, og halledes at Straalerne den hele Tid faldt lodret paa Kammeret.

Coagulation tides, the best straight after Belysningens Ophør, almost full paa Gjedemelk og udgjorde:

Ifølge et andet tilsvarende Forsøg 25 July 1903:

Efter 270 min Sollys .

Ubelyste Kontroltest.

41/2 mins

34/4

Det vil heraf sees, at Virkningen for this korte Tider er en vistnok tydelig, men svag Destruction.

When the microorganisms indicator is used, the antiseptics are applied to forestry Belysningen in the following days; If there is less interest, there is a risk that the future will take place.

Isteden tillader jeg mig at hidsætte et mig dengang ubekjendt Forsøg af O. EMMERLING [3], der i 5 days udsatte en med toluene reservateret Chymosinopløsning (A) for Virkningen af spredt Dagslys (B), dels for direct Sollys (C). Coagulation tides see sig at være:

For A (Control!) .... 8 mins

B.

C

21

12.35

After 5 days Belysning i direct Sollys he with other Ord Chymosinopløsningens Virkeevne nedsat to henimod en Trediedel af den oprindelige, tiltrods for at Belysningen he forest i et Glaskar.

The electric Lys from a Buelampe (45 volts, 30 amps, - and a Kultykkelse af respectively 24 and 18 mm.) Viser sign at have and no more powerful display; som det vil sees af

Forsøg XXIX July 13, 1903, before a 20 LøbeEXTRACTION OPLESNING is requested in et 3., mm. Ward chamber in a distance of 30 cm. fra Lysbuen.

Coagulation tides var:

Ved Forsøgene with Koncentreret Lys skulde paa dene Side Belysningstidens, paa den other Side Concentrationens Indflydelse paa Destructionens Forløb gjøres til Gjenstand for Undersøgelser

For these Belysningstidens Indflydelse, matte altid and samme Enzymopløsning used. Denne var en Osteløbeextract (Hansens), extended to 1/20 (from 1 vol. extract to 19 vol.

, Vand). Belysningen foretoges i et Kvartskammer af 3., mm. Tykkelse.

Hver Forsøgsrække udførtes uafhængig af other paa den Maade, at af risk tilberedte fortyndede Enzymopløsning blev udtagne Prøver Slag i Slag belyst i henholdsvis 5, 10, 15, 20, 25 and 30 minutes. Saasnart en saadan Serie var færdigbelyst, blev all Coagulationsprøver velvety igangsatte.

Deved til forskjellige Tider (June, July 1903) and further series of results he collected in Tables I and II, before Coagulationtiden he requested henholdsvis for Gjede- og Komelk.

Table I

Proven belyst:

coagulation tid

for 0., cm. chymosinopl. to 10 cm. Gjedemelk:

Forsog XVI Forsog XVIII Forsog XXI Forsog XXII Forsog XXIII

Som Helhed amounts to vil det heraf fremgaa, at the sker en større og større Nedsættelse af Coagulationsevnen, dermed and Forringelse af the virksomme Chymosinmængde, idet Coagulationstiden tiltager jo longer Tid Prøven har været belyst.

Table II

coagulation tid

for 0.cm. Chymosinopløsning up to 10 cm. Komelk:

Proven belyst:

Forsøg

Forsog IX

Forsog XV

X

Forsøg

XVI

Forsøg Forsøg Forsog Forsøg

XVIII XXI XXII XXIII

114/2

71/4 114/2

50

170

22414

O min 6 min 5°/4M. 71/2 min 8 min 8°/, min 8 min 8 min 8

min 5

20

18 | 30

15 12 10 13--14

35

30 150

19 18

16/2 15 16th 15th

55-60

31 24 20

80

82

ov. 360 34 30 127 25 175

90 34 37 30 30 210

53 60

83

173/4

Forsøger man at optegne de vundne Resulter grafisk for derigjennem at vinde en Oversigt over Destructionens Forløb, saa vil man for alle Rækker faa jævnt forløbende Kurver af nogenlunde den samme form, men longer strækker brighter ikke Ligheden sig.

If you count the Virkning, som f. Ex. 10 Minutes Belysning har done in the forskjellige Forsøg, vil you study over the i hoi Grad uoverensstemmende results.

Sætter man Virkningen i en vilkaarlig valgt Forsøgsrække lige med 1, saa viser den sig i en anden Række, which he udført under tilsyneladende ens Forholde at være lige med 10; i dette Tilfælde vil da Rækkens øvrige Observationer ogsaa ligge tilsvarende meget end den for Tilfældet as normal antagne Rækkes Værdier. Andre Rækker viser derimod en upaaklagelig Overensstemmelse.

The Lysinstitutet has a number of facilities in the clinic that is microbiological undersøgelser iagttaget Uoverensstemmelser in Lysets Virkeevne, and at one there is no more nærmere ind paa Spørgsmaalet. For this reason, if the clinical Undersøgelser has an approach to the main internal traffic, and if the microbiological Undersøgelser get a maximum effect, then it is in the Tid, said at Variationerne, before the percentage of the average local store, in the absolute valley is not vil gjøre saa stærkt gjeldende som ved de kemiske Forsøg - og da navnlig ligeoverfor katalyst, before en liden Forandring af the virksomme Substansmængde bevirker et stort Udslag.

In the case of Begyndelse tænkte jeg mig, at files maatte soges enten i Uensartethed i selve Enzymopløsningen, eller i Feil ved Coagulationsforsøgenes Udførelse. Et og samme lobe extract used the hele tid as the standard to all Udspædninger, saaledes at Enzymopløsningerne hver Gang var other saa lige som muligt. Derimod laa det jo ret nær at tænke sig, at Melkens Aciditet, der undertiden for samme Prøve forandredes ret meget ved nogle Timers Henstand i Laboratoriet, kunde være Aarsagen. En Ændring (Tilv æ xt) af Aciditeten vil som known i hoi degrees require coagulations. Of the ligeoverfor de korte Tider Ike vilde give nogen mærkbar Differents og saaledes ikke opdages med Kontrolprøven, kunden the aldeles forfalske Værdierne for the long Coagulationtider.

Forholdet ved blev imidlertid at være det samme, efter at each ved Siden af Coagulationsforsøgene paa Komelk gik over til samidig at udføre Parallelforsøg paa Gjedemelk), der melkedes i Laboratoriet lige før Coagulationsforsøgenes Begyndelse, og jeg paa denne Maade for hvert Forsøg fik corresponding Værdier.

The death in this case involves files that are filed in Vekslinger at Lysets Intensitet, or saved in Mængden af de af Forsøgsvædsken absorbered kemisk virksomme Straaler.

This is stated for clear information, at Lyskilden varierede, or at Forsøgsobjectets Absorptionsevne vekslede.

Forsøgsanordningen var altid i de at least Detailler truffet saa ensartet som muligt, lamps burned the bright Tid with the same Strømstyrke og Spænding, ligesom Lysbuens Stilling, Kraterets Form, cort says the bright Brændemaade ikke mærkbart for other words.

Trods al anvendt Forsigtighed staar det ikke til at undgaa, at Kullenes gjensidige Stilling paa Grund af Reguleringsmekanismen Ufuldkommenhed kan forandres lidt. Lysbuens Beliggenhed og Kraterets Form vil derigjennem kunne veksle ret betydeligt, uden at det giver sig tilkjende i Strømstyrke eller Spænding – men Kraterets og Buens Stilling vil jo i høi Grad bemme Mængden af de Lysstraaler, der kan opfanges af Concentrationsapparatet.

Imidlertid vil dette Forhold actually kun være applicable for at clear Uoverensstemmelser indenfor en og samme Observationsrække, og ikke mellem de forskjellige Rækker, saaledes som det her netop gjælder.

Som jeg nærmere viser Side 166, skyldes Lysets detruerende Virkning saa at sige udelukkende de ultraviolet Straaler. These absorbers are known to be let down by smaa Forurensninger, and the room is close by, at Apparatets større eller Minder Renhed (with Andtagelse af Frontlinsen blev Concentrationsapparatet kun Pudset en Gang i Ugen) customer udøve en væsentlig Indflydelse. Saa viste sig imidlertid ikke at være Tilfældet; om Apparatet ikke var renset paa flere Dage og derefter pudsedes omhyggelt midt i en Forsøgsrække, blev dette uden mærkbar Indflydelse.

1) Denne har iøvrigt den Fordel fremfor Komelken, at Coagulet blir fastere, og man faar en skarpere Observation.

Alt i old tror jeg, at files utvivlsomt maa søges i, at det trods al Omhu ikke he lykkedes at faa Lyskilden til at delivery in constant Mængde af ultraviolet Straaler og these nærstaaende Dele af Spektret.

At variations in the ultraviolet Straalers Mængde proportionsvis skulde være den samme som Variationen af de for samme Belysningstid fundne Coagulationstider, forudsætter, at curves for Destructionens Afhængighed af Lysets Intensitet skulde være regelmæssig (retliniet) for de Omraader, der her he Tale om. If it doesn't take longer than that, and the curves can move, at curves it has a saadant Forløb (en Inflexion), at and around Forøgelse or Formindskelse on the normal Lysmængde vil bevirke et uforholdsmæssigt disturbs Udslag for destruction (maalt som Coagulationtid).

Desværre kunden jeg af lack paa Tid ikke gaa nærmere ind paa dette point

And it says that there is no reason why it shouldn't be referred to for clearing other places and in Vekslingen on the ultraviolet streets.

The next really exact measurement, one has to determine the intensity of the spectrum for the forskjellige Dele, he (ved et bolometer) at maale the Energi, de representative.

Gjør man det for det elektriske Kulbuelys, som f. Ex. Snow [8] har gjort det, vil man se, at der i den ultraviolet Del ved H (Belgelængde 0.38 m) he en meget stærk, skarpt afgrændset Tilvækst i Intensiteten (Baand). Medium intensity here and try with Bolometer direct aflæste Skaladele udgør 350, viser the closest purple Del af spectrum (i G) and intensity of 75. For the other, synlige Del har intensity and mere jævnt Forløb af optil ca. 25.

That's what happens when the ultraviolet rays don't skyrocket in Ophav and the almost glowing layers of the crater and therefore it's brighter depending on the temperature, when the sky of Lysbuen is the same and the gaseous components.

Derved he det jo ogsaa meget sandsynligt, at Mængden af the ultraviolet Straaler i høj Grad maa være udsatte for Vekslinger.

Hvor stor Omhu, the end used pair at skaffe ensartede Kul, saa ligger det i Sagens Natur, at Mængden af de ved Impregneringen used Salte ikke kan være lige stor selv hos Kul fra den samme Sats.

Forholdet ved mine Forsøg var ogsaa det, at Serier udførte med det samme Elektropar, see Overensstemmelser, medens Virkningen efter Indsættelsen af new Kul oftente blev en helt anden.

Forest for sent he bleven clear over Aarsagen to this Feil, og jeg ved these Forsøg ikke havt Anledning to at udvælge en Lyskilde, the a priori havde Betingelserne for at kunne levere en constant Mangde af ultraviolet Lys.

Jeg has therefore helt maattet opgive at fastsætte kvantitative Forholde ved Lysvirkningen.

Enzyme mængdens Indflydelse paa Destructionens Forløb blev undersøgt i endel Serier, hvor Belysningstiden var constant. Hertil used Ostelebe extract. Denne belystes dels i den concentrerede Form, dels udspæd i forskjellige forhold, i et 3.7 min. Kvartskammer and Tid af 30 min. i Lyspletten fra a 50 volt 50 amp lamp.

Efter foretagen Belysning blev all Proverligere udspædde til en Fælles Concentration, saaledes at de 0.2 Cm.", the applied til Coagulationsforsøgene, modsvarede the samme Mængde af the oprindelige ubelyste Normalopløsning. Coagulationsforsøgene fore toges paa vanlig Maade.

The resulting results are collected in Table III.

Det vil heraf fremgaa, at Destructionen har været the more powerful, jo mere udspæd Chymosinopløsningen var ved Belysningen.

Paa dene Side er Aarsage hertil at søge i, at de concentrated Opløsninger har en gul Farve; Men væsentligst i en øget content of coloidale Molekyler, som allerede omtalt af GREEN for Diastasens Vedkommende [6 p. 187]. After Chymosinopløsninger med ens Farve see nemlig Destructions sig at være mindst der, hvor der var tilsat Æggehvideopløsning.

It says so itself, at the ved disse som de foregaaende Forsøg maatte blive store Uoverensstemmelser, og every afstod at udføre detailedlered Forsøg, indtil jeg kan faa en bedre Lyskilde.

The active road is that it is responsible for the destruction of the diastases, for GREEN you see the spectrum ultraviolet Del, and the customer derforms that is visible to you, for other enzymes, it is important that you see it in Helhed det fortrinsvis he de ultraviolet Straaler, the udover kemiske Virkninger.

Om Riggheden heref har jeg kunnet overbevise mig ved more Forsøg. Allerede Indskydningen af en ufarvet Glasplade foran Forsøgskammeret he noktil, at en 30 Minutes Belysning blir uden Indflydelse paa 1/20 LøbeEXT.

Som example hidden in each series, before 20 Chymosinopløsning blev belyst med forskjellige Spektralafsnit, idet Lysfiltre indskjodes foran Forsøgskammeret.

Det vil heraf sees, at brighter ikke Spectrets other Dele enkeltvis udøver nogen Indflydelse paa Chymosinet.

In the case of all urban Belysningstidens Varighed til et Par Timer, kunden any longer Gange opnaa in Nedsættelse af Coagulationstiden med 1/4-1/2 Min.

Samenholder jeg the result with EMMERLINGS (Side 160), he det jo ret paafaldende, at the concentrerede Lys blir uden Virkning, near the ultraviolet Straaler fjernes. The trænges imidlertid yderligere Forsøg, since Angivelserne med Hensyn til Dagslysets Virkning he ret usikre.

Eftervirkninger: Over hele Lysbiologien erdet et eiendommeligt Fænomen, at Lysvirkningen reactions ikke melder sig straks, men først efter nogen Tids Forløb; Often he does that to and with just Eftervirkningerne, which he det karaktistiske.

Ogsaa for Lysets Virkninger inden the inorganic Kemi kjendes lignende Forholde. He said all about BUNSEN and Roscoe in their classic undersøgelser over Lysets Virkning paa Klor- og Vandstof-Gasblandinger fremhævet som fotokemisk induction [12].

GREEN [6] har i sit Arbejde over Diastasen vist, hvorledes en Opløsning, der ved Belysning var svækket 42 %, efter 6 Ugers Henstand i Mørke yderligere var svækket saaledes, at der kun var Spor af Diastase tilbage.

Meget taler jo for, at en af Lyset indledet kemisk Proces, navnlig paa reason af Mellemprodukternes reaction, trænger en vis Tid før de løber tilende, for Ligevægt indtræder. Forsøg he ret ufuldstændige.

Ved nogle Prøver, the efter ends Belysning tilfældigvis henstod i c. /. Døgn i lukket Glasrør i Laboratoriet, var Løbetiden for andret from 3/4 to 43/4 min., from 4 to 53/4 min., from 111/4 to 17/2 min., from 23 to 31 min.

Efter 1 Døgns Henstand see the following tests in noget større Nedsættelse af Løbeevnen, idet Coagulationstiden var øget from 91/1—204/2 min., from 111/2 to 36 min., from 12/2 to 33 min ved all Bestemmelser collect Coagulationstid for normal Lobe. This Forsøg blev gjort mere tilfældigt. rock

Mine

towards Forsøg gjordes udelukkende for at se en mulig Eftervirkning.

Forsøg XXXI July 14, 1903 with 120 extracts of Løbelyst i 20 min. Coagulationtiden for Gjedemelk var:

Forsøg XXXXIX July 28, 1903 with 1420 Lobeekstrakt belyst i 15 min. Coagulationtiden for Gjedemelk var:

medens the ubelyste controløbe the hele tid coagulerede milking paa 3 min.

Hvorledes Eftervirkningen vilde stille sig gjennem longer Tid (dvs under antiseptic Kauteler) blev ikke undersegt.

Sensitization: Om Lysets kemiske Virkninger har det i longer Tid været kjendt, at which kan forøges ved Tilsætning af visse Substances, the enten ved sin egen Absorptionsevne for de virksomme Straaler virker som en slags Transportør af Lysets Energi (optical sensitization), or derved, at de tilsatte fabrics binder

, nogen af the opstaaende products and derigjennem paaskynder Reaction hastigheden (chemical sensitization).

hv TAPPEINER and hans Elever [9] (RAAB, Jacobson) have first seen, at Lysets Virkning paa lavere Organismer i hoi Grad foreges i Nærvær af meget smaa Mængder af visse fluorescerende substances. Ved Forsøg paa Lysinstitutets Laboratorium he det lykkedes DREYER [10] at vise, at Mikroorganismer ved Sensibilisering kan gjøres følsomme overfor de ellers uvirksomme Dele af Spektret.

Det laa derfor nære at forsøge, om the synlige Dele af Spektret ved Tilsats af fluorescent substances to en Chymosinopløsning customer paavirke thenne. Jeg hidsaetter:

I Forsøg XXXIV July 21, 1903, before det conc. Lys first fik passere et glass filter with distilled Vand, blev lobe extract, the var udspæd i Forholdet 1:20, tillsat with erythrosine (tetraiodofluorescinodium) blaat eosin til kraftig fluorescens, anbragt i et 3.2 mm. Forsøgskammer and belyst i 30 min., and then at no Indvirkning kunne spores, the coagulation tides for the belyste and ubelyste test var henholdsvis 41/4 min. and 4/2 min.

I Forsøg XXVII July 11, 1903 blev en Opløsning af Chymosinogen tillsat Erythrosin till all fluorescence and belyst i et 3.2 mm. Chamber 30 min. med det samlede concentrerede Lys fra en 50 amp. Lamp. Ffter Aktivering with Saltsyre sees the sensitized som the ikke sensitized velvety tested Prøve the same content of chymosin, said at the tilsatte erythrosin i the Tilfælde brighter ikke har havt nogen Indflydelse paa de ultraviolet Straalers Virkeævne. However, it was not recommended to at Fortsætte Forsøgene.

Efter at jeg havde skrevet foranstaaende, har v. TAPPEINER [5] and STRONG disclosed interesting research with fluorescent substances Indflydelse paa enzymes [11].

V. TAPPEINER visible, at several forskjellige fluorescent substances (eosin, Magdalarødt, Chinolinrødt) paavirkede Opløsninger af Diastase, Invertin og Papayotin ret kraftigt, naar de udsattes for Dagslyset. You can see that the Belysningen foretaget in Glaskar, and that he sees the room, at the other end of the spectrum there are effective values for the spectrum or sensitization that can be applied to enzymes. Maatte Lyset først passere et Filtrum med the paagjældende fluorescent Substans, blev det uden Indvirkning.

Ikke fluorescent substances with lignende absorption levels (fuchsin, azofuchsin with fl.) lod sig ikke used as sensitizers.

STRONG has navnlig studeret Diastasens Forhold ligeoverfor Sensibilisering med the forskjelligste color substances.

Begge Forskere have de on the applied Belysningsforholde fundet Dagslyset at være uden Indflydelse paa de rene Enzymopløsninger.

chymosinogenet. Som Tilfældet he med de fleste enzymes, finds chymosinet required in the effective form tillige i en uvirksom form, som zymogen or proenzyme.

The nature has a store of interest at undersøge, in front of the Chymosinogenet Chymosinets Proenzym for holdst sig ligeoverfor Indvirkningen af Lys.

That said, it is clear with Lethed gjøre, since Chymosinogenet holds i riglige Mængder ved at extrahere en Kalvemave med svag Kogsaltopløsning.

Vistnok gets man velvety ogsaa smaa Mængder af Chymosin; These can be stored and added to amounts over the store Mængder Chymosin, which can frigjøres ved at lade en svag Syre virke paa Proenzymopløsningen (Kalvemave extract!).

Det ligger i Sagens Natur, at man herved ikke kan holde Opløsninger af endog kun tilnærmelsesvis the same enzyme or zymogen content, og de Forsøg, jeg har udført, kan derfor ikke sammenstilles, men maa beskrives hver for sig.

Forsøgsanordningen var the following: En frisk, vel afvasket Kalvemave (soon!) maledes i Kjødkværn and extra here derefter nogle timer with sin approx. femdoubble Mængde 3% Kogsaltopløsning. Filtreredes derefter Natten over i et Isskab. The extracted extract is then added to the larger volume and the number of filters is used for the application to the undersea.

Saavel for de belyste som ubelyste Prøver faldt Undersøgelsen i to, idet Mængden af færdigdannet Chymosin for the best pair of Maade with 0.1 cm.3 to 10 cm.3 Gjedemelk. The next most active Proenzymet and the Mængde mains, it is necessary to have large volumes of Opløsningen and 1/10 Saltsyre over 30 min. til at best coagulation tides paa Gjedemelk.

The herved fundne Coagulationstid represent vistnok Mæng. den af oprindeligt plus det frigjorte chymosin; Men da det sidste i Mængde he fully dominates, vil de efter Aktiveringen fundne Værdier i hvert Tilfælde kunne anvendes som et Maal for Mængden af Chymosinogen. Jeg har ikke taget noget Hensyn til, at de Fundne Værdier representative en Opløsning, which he Halvparten saa concentrated som den, hvorpaa Belysningen foretoges; All Værdier have all Afsnit en absolutely relative Værdi og maa kun ses i Forbindelse med Forsøgets other Værdier disse alle er en halv Gang for store spiller ingen Rolle.

Forsøg XXXV July 22, 1903 udførtes for at se Belysningstidens Indflydelse. Belysningen foretoges paired with dimensions and 3.2 mm. Kvartskammer. The results are collected in Table V:

This is what happens, at other times Proenzymet powerfully destroys the concentration of Lys and it causes Udstrækning with Belysningstidens Varighed. In Belysningstid af kun 5 min. har været nok til at ødelægge approx. 77% af Proenzymmængden, which vil sige nedsætte Coagulationsævnen med 300%.

I Forsøg XXXIII July 17, 1903 blev Virkningen af de ulige Spektralafsnit undersøgt paa et friskt tilberedt KalvemaveEXT. He compiled the results in Table VI.

The fremgaar heraf, at man kun har en sikker Virkning, to the ultraviolet Straaler faar ledning to Virke, hvilket yderligere bestyrkes bl. a. af Forsøg XXXV b., XXV and XXVII.

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I Forsøg XXXV b. (before the same Opløsning as i XXXV applied) var the foran Forsøgskammeret indskudt et ufarvet glass filter. Further active rings are shown in Proenzyme, after 30 minutes. Belysning shows changes and coagulation rates in 91/4 minutes, and then a control test in 91/2 minutes.

I Forsøg XXV July 10, 1903 blev en Chymosinogenopløsning belyst 1 time bag et glass filter with 5% KCr04 Opløsning. Coagulation times for the first and last test are identical, namely for the active ring 18') and after 28/4 min.

I Forsøg XXVII the 12th July 1903 blev en Chymosinogenopløsning belyst i hele 2 timers with concentrated Lys, which had passeret et glass filter with 5% KCro, Opløsning. Coagulation tides for the ubelyste var 304/2 min. for og 5 min. efter Aktivering med "/10 Saltsyre; for the belyste Prøve henholdsvis 33'/, min. og 5--5/2 min.

Nogen activating Virkning af Spektrets at least bredbare Dele, says that GREEN has iagttaget for Diastasens Proenzym, har jeg ikke fundet. After that, GREEN should be særlig de røde, when I have all the roads to and with the blaat besides Evne.

Desværre har jeg paa dette point ikke havt Anledning til at træffe the samme Forsøgsanordning, which af Green applied. Navnlig has the af migly applied Lys været adskillige hundredse Gange stærkere, og Aarsagen til, at Chymosinogenet har heldt sig other led end diastasens zymogen, kan eventuelt soges heri.

Ogsaa svagere Lyskilder som spredt elektrisk Buelys og Sollys har vist sig at have en destructive Indflydelse, naar Belysningen foretoges i kvartsceller, saaledes at de ultraviolet Straaler fik virke, f. Ex. i Forsøg XXXIX July 23, 1903. Et friskt til beredt Kalves i 45 cm. Distance from a 30 amp lamp. Efter Aktiverring var coagulation tides:

I Forsøg XXXVIII July 22, 1903 blev Kalvemave extract belyst med skarpt Sollys i 1.5 mm. Kvartskammer. Coagulationtiden var for the ubelyste Prøve 11 min. for og 14/2 min. after Aktiveringen; for the i 3 timer belyste Prøve henholdsvis 11 min. and 13/4 min.

Forsøg XXXXVIII 26 and 27 July 1903 foretoges med MaveEXT i to ulige Udspædninger (a og b). Belysningen skede i 1.5 mm. Kvartskammer i straalende Solskin. Coagulation times for Gjedemelk (0,1-10) are still indicated as follows:

Direct:

Efter active ring:

I Ubelyste Prøve 23'/. at least 21). minutes

24/7-2314

a

26/2

n

{ yhelimee Son

b{ Ubelyste Prove 66

51/4 54/4

Sol

67

Det vil af disse Forsøg med svage Lyskilder ses, at every ligesaa lidt her som ved Forsøgene med concentreret Lys har iagttaget nogen gavnlig Indflydelse – Aktivering.

antichymosinet.

Som first seen from HAMMARSTEN and RODEN [13], besides normal blood serum levels to at least Virkningen on other neutralized forskjellige Enzymopløsninger. HAMMARSTEN saa saaledes, at Caseinopløsninger or Melk tillsat med lidt Blodserum ikke longer paavirkedes af Chymosinet.

Dette Anti-Chymosin Antilab) should be given to Gjenstand for nearer Undersøgelser af Røden og senere af Fuld og Spiro [14] m. fl.; This is the maximum in the number of samples in the serum and can be generated from the intravenous injection of the associated enzyme. Ved Ophedning destroys the ved temperature of around 70° C.

and that has i sine Egenskaber adskilligt tilfælles med Enzymer. This is based on the anti-enzyme groups in the group that has the same status as the Opmærksomhed.

RODEN, Fuld and SPIRO have further sine Forsøg paa den Maade, at de til en given Melkemængde har sat vekslende Mængder af Serum og Chymosinopløsningerne. Ved et tilstrækkeligt stort Antal Prøver var the paa denne Maade muligt at se, before meget the af the affected serum (antichymosin) var necessary for at hindre milking fra at coagulere, naar and bestmt enzyme levels tilsattes; men derved fik man ingen Besked om, hvorledes enzyme og antienzyme gjensidig paavirkede hverandre, idet milking i aile Fald paavirker Chymosinet.

At follow the af these Forskere angivne Forsøgsanordning var af rent methodiske Aarsager forkastelig. Ogsaa derfor at de Mængder af Serum, jeg med rimeligt Besvær kunden faa gjennemlyst, paa reaches nær vilde strække til, matte jeg anvende en anden Fremgangsmaade.

Is it necessary to have large volumes of enzymes and anti-emzymopløsnerne react directly to each other and to other tides to measure the effectiveness of the enzyme when the enzyme is loaded at 0, cm.? about 10 cm. Melk and derigjennem days Coagulationstiden som et Maal for samme. At the udførtes parallel Kontrolforsøg he selvsaid. Som vist af Fuld og Spiro [14] indholder Serum vistnok ogsaa Chymosin; men for de smaa Mängder 0,05 Cm.", the anvendtes ved hvert Forsøg, kunde dette sættes ud afmounting.

Forsøg XX July 5, 1903: Hertil applied and sterilized Kalveblodsserum, which lasted 30 min. i et 3., mm. Kvartskammer og derefter sammenblandedes medium volumes of 1/10 lobe extract.

Efter at Blandingen has a duration of 100 minutes, see Coagulationtiden sig at være 71), for Gjedemelk and 17 for Komelk. The parallel test beforehand (high volume of the serum and 10 extracts) is after 100 minutes in a coagulation stage of 13.5 and approx. 27 minutes. , Min. henholdsvis for Gjede- og Komelk. It is hereafter, at 30 minutes.

Forsøg XXXXIV July 24, 1903: Det samme Kalveserum som i foreg. Forsøg blev belyst i 30 min. and 60 min. Blandingen's Coa

. Guulationsevne bestemtes efter 100 and 200 min. Forløb paa Gjedemelk (0., --10 som vanligt).

1

Medium of the lyste Serum has nedsat Chymosinopløsningens Coagulationstid from 3/4 to 91/4 and 18, dvs med 6 and 15 min., har det ubelyste nedsat den med 4 and 7. Min., hvilket betyder, at Antichymosinet he svækket med ca. 40%

Forsøg L July 29, 1903 blev udført med Hesteserum '), the belystes dels direct (A), dels efter Fortynding til 1/2 (B) og '/4 (C). All Prover hensattes derefter med 10 LøbeEXTRACTION.

Efter 3 Timers for A og efter 14 Timers Forløb for B og C bestemtes Coagulationtiden med Gjedemelk.

Som det fremgaar heraf has Svækningen af Antichymosinet tiltaget med Belysningstiden, every 30 min. Belysning has ødelagt 50%, 60 min. Belysning 62%

02

1) dr Th. Madsen ved Seruminstitutet i Kbh. Still the greatest to my disposition.

Det vil sees, at der ved Belysning af det fortyndede Hesteserum er found særdeles varying results, idet det conc. Lys baade has formindsket and forøget Mængden af Antichymosin.

If it is Virkeligheden he saa, som det jo fremgaar af Forsøgsprotokollerne, at Antichymosinets Mængde kan forøges ved fysikalske Indgreb (her Lys), skal jeg indtil videre lade uberørt. Jeg har imidlertid, trods Forsøgenes lackfuldhed, dog villet tage dem med nu, om jeg ikke skulde faa Anledning til at fuldfere endel other Forsøg, der ogsaa peger i samme Retning.

Om Proenzymernes Forhold til Serums antibodies foreligger the saavidt migjendt ingen Undersøgelser.

Each has been recorded in the Forsøg in the Retning, idet each has loaded Chymosinogenopløsningen paavirkes af lige volumes upfortyndet Kalveserum nogle timer; med Undtagelse af et Forsog har jeg ikke fundet, at Serums Antistoffe udover nogen Indvirkning paa Chymosinogenet. I said one Tilfælde nedsatte saavel det ubelyste som det i 30 min. Belyste Kalveserum en Opløsningschymosinogenmængde saaledes, at the efter Aktivering visit en Coagulationstid after 20 and 21 min. mod 11 for Kontrolproven (Forsøg XXXVI 22. July 1903). At the end of the day, vanskeliggjøres naturligvis ved the Syrespaltning, which he needs for at overføre Chymosinogenet i Chymosin. Derved kan mellem Chymosinogenet og "Antienzymet" indtraadt Forbindelse löses. Isaafald vil Masseforheldene mellem Syre og absolute Enzyme Mængde kunne dirigere Processen i oleige fibre, og derved ogsaa for klarere de overensstemmende Results.

Slutning

The general result of the ongoing investigation has a clear sign, at the same time Chymosinet, Chymosinogenet as Blodserums Antichymosin i high degrees paavirkes on the concentrated electric Buelys, navnlig on the ultraviolet Del.

Naar det lykkes at skaffe et conc. Lys med en constant Mængde af ultraviolet Straaler, vil man have et nyt Hjælpemiddel til at studere Enzymer, Proenzymer og Antistoffe hver for sig, som i otheres gjensidige Forholde.

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RADIUM BEAM LEARNED INDVIRKNING PAA

chymosin

AF

SIGVAL SCHMIDT NIELSEN.

With the særdeles kraftige physiologiske Virkning for Øie, som udøves af Radium-Præparater, ligger det jo ret nær at days, at de ogsaa har en kraftig Indvirkning paa Enzymer.

Som særlig egnet for en Undersøgelse herover valgte jeg Chymosinet, for that jeg ved tidligere Undersøgelser (the booklet p. 151) havde fundet, at det var let paavirkbart af ultraviolet Lys, that ogsaa for the relative enzyme Mængde i en Opløsning heraf med stor Nøiagtighed lader sig fastsætte ved Hjælp af Coagulationstiden lige overfor Mælk.

De first forsøg udførtes ved Lysinstitutet i July 1903. Jeg havde dengang 1 Gram af et ældre Radiumpræparat med angivet Styrke af ca. Preparatet opbevaredes i et Glasrør. Under Exponeringen var dette nedsænket i Vædsken, which var anbragt i et almindeligt Reagensrør. To hvert Forsøg anvendtes kun 2 cm.: for all Dele af Vædsken skulde I come to the most mulig intimate Berørelse med Straalerne. Chymosinopløsningen var et Osteløbeekstrakt from Chr. Hansen i København udspædt med Vand til 20Coagulationsforsøgene udførtes ved 37° med Gjedemælk straks efter ends Exponering og saaledes at der til 0.1 cm.? Chymosinopløsning whopping 10 cm.3 Mælk.

The found results still indicate the following:

1. July 26, 1903. Efter 24 Timers Exponering var Coagulationstiden 54/4 min., with the for Kontrolprøven var 3 min var 4 min. I dette sidste Forsøg var Rørets Yderside dækket af et tyndt Staniolbelæg.

Begge Forsøg udførtes i et mørkt Rum.

In December 1903 there were many reports from Professor K. ÅNGSTROM Anledning to i Upsala at anvende 0.1 Gram from et "Det Fysiske Nobel-Institut" to listening Radiumpræparat med opgivet Styrke ca. 1,800,000 (fra Societé Centrale de Produits Chimiques, Ancient Maison Rousseau, Paris). Dette Præparat var anbragt i et tilsmeltet Glasrør, der for at beskytte Præparatet anbragtes i et særdeles tyndt

Glasrør. This is requested directly in the Enzymopløsningen, the other passageway and 20 vanding Ostelebeekstrakt, men nu fra Barnekow in Malmø. Det til hevert Forsøg used Vædskevolum adgjorde 5 cm.

Results var:

I. At December 17, 1903 var efter 15 Timers Exponering Coagulationstiden nedsat fra 71/2 til 9 min.

On December 18, 1903 var efter 8 Timers Exponering Coagulationstiden nedsat fra 9 til 10 min.

The har saaledes fundet in vistnok sikker, men meget svag Destruction Sted. Most paafaldende he det, at Destructionen i de to sidste Forsøg ikke he større end i de første, til Trods for at den Energimængde, der har Anledning til at virke paa hver volumehed af Vædsken he ca. 72 Gange saa stor.

There, as known, on Becquerelstraalerne de saakaldte a-straaler ikke can passere gjennem Glas, skulde Virkningen tillskrives B- and y-straalerne (9: de Katode og Røntgenstraaler nærmest staaende).

Imidlertid er jeg most tilbøjelig til at tro, at Virkningen ikke direct skyldes selve Becqerelstraalerne, men en secondary Virkning af ultraviolet Straaler. Behaved one forsøgene i Mørke, vil man nemlig iagttage en strong Phosphorescens ikke alene i selve Forsøgsrøret, men ogsaa i hele dets Nærhed. The ultraviolet rays, which derved i smaa Mængder then paa Forsøgsrørets Inderside og eventualt i selve Vædsken vil gjennem the long tid

Formally strække til for at fremkalde saa ringe Virkninger, som de, hvorom der her he Tale.

Every time it is necessary for bindings and very little, at every Forsøg with Røntgenstraaler (nærmest y-Straaler) har fundet this at være uden Indflydelse paa Chymosinet, near Bestraalingen varede in 15-20 min.

OUT

FINSENS MEDICINSKE LYSINSTITUTE

(FINSENS MEDICAL LIGHT INSTITUTE)

IN COPENHAGFN.

TENTH ISSUE.

WITH 1 PLATE, 12 CURVES AND 6 FIGURES IN THE TEXT.

SEMPER

BONUSES

ARTIBVS.

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1906

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I

(From the physics department of the physiological institute in Berlin.)

About colored light filters.

Some photometric studies.

Of

Gunnie Busck.

In the case of light-biological investigations, the requirement that the quality of the light used must be precisely determined in each individual experiment has gradually come to the fore, because the effect in the different spectral sections is usually different; there are even examples of an almost antagonistic effect of rays of different wavelengths. Much less emphasis has often been placed on the exact determination of the intensity of the spectral lights; and yet this is no less an important link in the experimental light-biological technique than the spectroscopic investigation of the nature of the rays. Numerous examples can be given of the fact that strong and weak light can have qualitatively different biological effects: Strong light is known to have a destructive effect on such organisms, for communications a. Finsens Medical Light Institute.

1

X

which less intense exposure is, in the long run, a condition of life; an organism can be negatively phototactic to strong light and positively phototactic to weak light, etc.

It is, however, often very difficult to obtain monochromatic light of a certain intensity, especially when a larger area is to be uniformly exposed.

The greater the demands placed on the monochromatism of light, the narrower the limits one wants to draw for the spectral range with which one intends to work - the more difficult it becomes to obtain sufficiently strong light. Of course, the intensity can be increased by concentrating the rays in question, but the size of the exposed area is then reduced to a corresponding degree.

The methods that can be used when it is a question of producing light of a certain refractivity are as follows:

1. It can be used light sources, which exclusively or preferably beams of ge. send desired wavelength.

Ultra-red rays are obtained e.g. B. by heating a piece of dull-blackened metal to slightly below red-hot heat.

Monochromatic light in the narrowest sense is emitted by individual glowing metal vapors, such as e.g. B. the sodium and thallium flame, respectively. in yellow and in green.

A light source emitting exclusively ultraviolet rays is not known; but by the use of induction sparks between magnesium electrodes, arc light between cooled metal electrodes (BANG), or a quartz mercury lamp , a light much richer in highly refractory rays can be produced than the light of the light sources commonly used.

2. By means of the prismatic decomposition of the "white" light, an ideally monochromatic light can be obtained everywhere in the spectrum, but the collimator slit must then be made so narrow that the light intensity in the individual spectral sections is very low, even when using a powerful light source becomes.

3. Finally, there is the method of filtration, which must generally be employed where a larger area is to be exposed, or where particularly intense light of somewhat similar refractivity is required.

Colored glass plates have long been used as light filters; their merits lie in their ease of use and relatively long-lasting colour, but in other respects they leave much to be desired. Only the red cased glass (ruby glass) emits monochromatic light in thicker layers, all other types of glass allow rays of quite different refractive power to pass through. In addition, the color nuance is often different on different parts of the same glass plate. RALEIGH) and KIRSCHMANN? have recommended stained collodion or gelatin plates as filters. The fact that the aniline dyes used in their manufacture bleach very quickly in the light -- apart from the fact that gelatine does not tolerate moisture or heat -- has meant that these filters have gained only a limited popularity. In addition, the brightness of the transmitted rays is generally not great.

1) RALEIGH, Nature 1881. 2) KIRSCHMANN, Philos Studien von \'. WUNDT, VI, pp. 543-552. 1891

Significantly better results, both with regard to uniformity and luminous intensity, are obtained by means of colored liquids enclosed in glass vessels with ground plane-parallel walls. By combining such filters - or by directly mixing different dye solutions - one can obtain reasonably monochromatic light-emitting filters.

I do not wish to enter into a discussion of which dyes are best suited for the manufacture of filters of this type, but rather refer to LANDOLT's) and NAGELS 2) work in this area.

The latter writer has put together a series. specified dye solutions, which give approximately monochromatic light of relatively high light intensity in different spectral sections.

However, the limits of the spectral range that such a filter allows to pass are rather indistinct and, in practice, they also vary with the concentration and thickness of the liquid layer on the one hand, and with the intensity of the light used on the other. They can generally be determined fairly easily by simple spectroscopic examination.

However, a quantitative determination of the light absorption in a particular radiation filter - a determination of the extinction coefficient - requires a great deal of time if it is to be carried out with only approximate accuracy; moreover, the inventory necessary for such an investigation is probably not available in many cases. The tables below on absorption in quite a few common

I) LANDOLT, Berl. German chem. Society, 1894, p. 2872.

2) NAGEL, biologist. Zentralblatt, XVIII, p. 649. 1898.

The light filters used will therefore perhaps have a certain practical value for those researchers who are engaged in light-biological experiments.

For my investigations I used a HELMHOLTZ spectrophotometer 1). As a light source I used Nernst lamps or, to be more precise, two frosted glass panes of the same size, each illuminated from behind by a Nernst lamp and fixed in front of the corresponding collimator columns. – I worked in the dark room and the Nernst lamps were surrounded by light-tight metal cylinders with the frosted glass mentioned above attached to the front wall. The prism of the spectrophotometer was also protected from extraneous light by opaque velvet curtains.

I always prepared the dye solutions immediately before the examination, using freshly boiled distilled water (to avoid the formation of air bubbles on the walls of the filter). The solutions were enclosed in glass vessels with ground, plane-parallel walls. The thickness of the liquid layer was

The filter was placed perpendicular to the direction of the beam just before one of the collimator columns.

Before each use of the spectrophotometer, it proved necessary to re-determine the zero point of the collimator slits and the position of the sodium lines in the two spectra, in order to subsequently correct the settings. The position of the Nikol prisms also had to be constantly checked.

During the investigations I proceeded as follows: After placing the relevant filter in front of the light

I cm.

1) A description of this apparatus can be found in this journal, IV, p. 217 ff. 1892.

source, I only determined the limits for the spectral sections passing through with a wide collimator gap (1 mm). A systematic quantitative measurement of the luminous intensity at a series of points corresponding to rays of different wavelengths was then made. half of these spectral sections. The ratio between the widths of the collimator slits after each setting I used as a measure of the absorption of the filter for the radiation quality in question.

The tables below therefore give the luminous intensity measured in the various spectral sections, expressed as a percentage of the original luminous intensity. Each of the numbers is the mean of a total of 10 settings, five with the filter in front of the right and five with the filter in front of the left collimator slit. Furthermore, I checked the correctness of my measurements by repeating the entire examination of one and the same filter with an interval of a few days, or by determining the absorption curve for twice the filter thickness or for a twice as strong solution of the same dye, and then comparing it with the calculated one compare curve.

Since these control experiments showed that my error limit was 5 per cent, I considered it correct to correct my statements within this space according to the probable course of the absorption curve.

Saffranine 0.04% 75 80 85 87 87 85 81 74 64 45 25 8 3 0 0 0 0 0

bichromic

Potassium 5%

45 55 6372 80 87 94 90 80 80 87 87 80'70 60 43 15 6

Monochrome acidic potassium

5%

73 80 86 92 95 94 90 89 90 94 96 96 96 95 94 91 88 84

Picric Acid 1% 78 85 91 95 97 97 95 91 90 90 90 90 90 90 90 92 95 94

Orange G. (MURDERER) 1%

85 88 89 90 90 90 90 90 90 88 80 65 45 151 1 0 0 0

Light Green (GROUBLER) 0.25%

80 75 60 33 9 2 0 0 0 0 0 0 0 1 4 8 14 25

Methyl Green (GRUEBLER) 0.0001%

67 65 62 55 24 40.5 0 0 0 0 0 0.5) 1

4! 6 10 15

0 0 1 2 4 7 14 24 35 44 52 59 65 70 75 79 81

cuprammonium

sulfate 5%

oooooooooooooooooo

O

picric acid gi sat. solution of

copper acetate

0 0 0 0 0 2 3 5 8 13 19 30 42 55 65 71 74 75

g 100

lithium carmine

0.1%

oooooooooooooo 0 0 0

Monochrome

acid potassium 80 74 63 48 32 15 5 1 0 0 0 0 0

5%

Picric acid 1% 90 82 6950 25 9 3 0 0 0 0 0 0 0

copper acetate sat. solution

83 84 85 85 85 85 85 85 8585 85 85 85 85 85 85 85 85

cuprammonium

sulfate 5%

0 0 0.5 1 2 4 6 9 12,17,21 28 35 42, 46 49 50 51

picric acid g 1 sat. solution of

copper acetate

75173 65 50 25 9 4 1 0 0 0 0

ooo

g 100

Since the numbers in the table below indicate the percentage ratio between the intensity of the spectral rays before and after passing through the filter in question, their value is independent of the light source used.

The absorption ratios of other filter thicknesses and other solution ratios of the dyes examined can be determined from the figures given here. It is particularly convenient to use Engelmann's1) tables for this purpose, in which the necessary calculations are carried out once and for all, and in which one can also easily find the extinction coefficients which correspond to the absorption ratios given here.

In the attached curves I have graphically represented the absorption ratios of the dyes examined in two or three different strengths of solution. The thickness of the filter is for all: 1 cm. Along the abscissa, the wavelengths of the beams are separated according to their divergence in a dispersion spectrum.

The intensity of the filtered light, expressed as a percentage of the original light intensity, is plotted along the ordinate.

The above investigations were carried out during a study visit to the Physiological Institute in Berlin (directed by Prof. ENGELMANN) in the physics department headed by Prof. NAGEL. I ask Prof. W.

. NAGEL and Dr. medical PIPER to accept my heartfelt thanks for the help they have given me in my work.

1) W. ENGELMANNS Verlag, Leipzig.

sat. Lourg I a 5

Panel XI: Cuprammonium sulfate

b 2.

Plate XII:

| Picric acid size 1.

sat. Solution of copper acetate gr. 100.

Red.

Orange.

Yellow.

Green.

Blue.

Indigo.

Violet.

701 165a BC

panel 1

Red.

Orange.

Yellow.

Green.

Blue.

Indigo.

Violet.

Plate XII.

II.

Contribution to the investigations into the photo chemical skin reaction').

Of

Gunnie Busck.

The hypothesis put forward by CHARCOT?) in 1859, that the solar erythema is due to an effect of the chemical rays of light and not, as was previously assumed, to the heat rays, found experimental confirmation only 30 years later through WIDMARK's experiments. Since that time, interest in this question has increased significantly, especially because of its great importance for FINSEN light treatment, and a number of researchers have contributed in various ways to expanding our knowledge of the nature of the light reaction and the conditions under which it occurs. I want to touch on only one side of these investigations here.

1) I carried out the above investigations at the request of Prof. FINSENS, whose intention it was to use them as an experimental basis for a section of his planned treatise on the light reaction in the skin. Since, in my opinion, my experiments could be of interest both in a theoretical and in a practical respect, I feel authorized to mention them now that Professor Finsen has passed away.

2) Comptes rendus de la soc. de biolog., 1859, p. 63.

3) Hygica, fixed volume 1889.

As early as 1885 UNNA 1) put forward the hypothesis that the skin pigment serves to protect against light, but it was only through FINSEN's 2 classic experiments that the interaction taking place was proven: the light, which causes pigmentation of the skin - and the ability of the pigment to To protect skin against further harmful effects of chemical rays of light. It is known from plant biology how the structural relationship of the leaves adapts to the prevailing lighting, e.g. B. that the palisade parenchyma in leaves exposed to direct sunlight develops into a tall, protective layer, while in shaded leaves of the same plant it acquires little development. A similar ability to adapt to the intensity of the light, FINSEN managed to demonstrate in relation to humans and he thereby gave the natural solution to the question of the cause of the dark skin color of Negroes. In connection with this he also mentions the striking lack of pigment in the palms of the negroes' hands and in the skin of the soles of their feet; he regards this as a sign that a thick layer of epidermis is also capable of protecting the body against the inflammatory rays of light.

FINSEN listed the following as the factors that play a role in the development of light erythema: quantity and intensity of the light rays, duration of exposure, degree of pigmentation of the skin and finally the thickness of the epidermal layer.

In order to further investigate the skin pigment's ability to prevent the light reaction from occurring, I first tried the different degrees of pigmentation

I) Monthly magazines for practical dermatology, vol. IV, no. 9.

2) Hospitalstidende, July 5, 1893.

to imitate artificially by using stain to paint a scale of unequally blackened areas on the volar surface of my left forearm. I then exposed a number of small spots within each of these parts to concentrated electric light of a specified intensity, in order to find the shortest exposure time in which a just visible skin reaction could be produced. It turned out that the times increased very strongly with the degree of blackening.

However, since it was not possible to describe the nuances of the blackening more precisely, and since the conditions differ quite significantly from the conditions in naturally pigmented skin, I proceeded to determine the relative sensitivity of the skin to light on various parts of the body . FINSEN had already observed earlier that the skin can show great differences in this respect.

My experimental arrangement was as follows: The light from an electric carbon arc lamp of 70 amperes, 48 volts was concentrated by a Finsen 8 cm collector with rock crystal lenses. In the cone of rays about 3 cm outside the focus, a water-trickled pressure glass was firmly attached, so that I worked with constant light intensity. A piece of paper was taped to the outside of the printing glass, and I had cut a small, star-shaped hole in the middle. If the skin was pressed against the printer, only a small, sharply defined spot was exposed. The light response is thereby more prominent against the surrounding skin and also becomes so small that a number of exposures can be accommodated within a limited area of skin. I then determined the exposure time required for each region to produce a just visible reaction. The method consisted in combining a number of pre-designated spots within the same region, e.g. e.g. 5, 10, 15, 20, resp. were exposed for 25 seconds. If there was a reaction on the last three spots but not on the first two, 15 seconds was set as the minimum time required for the region concerned. The spots were examined 4, 6 and 8 hours after the exposures; the point in time at which the reaction occurs in the different regions varies.

The times found are shown in the attached table:

ver

face (left cheek)

Breast

the back

abdomen

radial side of the upper arm

uinar side

Cubitus

volar surface of the forearm

dorsal surface

radial surface

ulnar surface

dorsal surface of the wrist

dorsal surface of the hand

volar surface

Femur's tibial surface

fibular surface.

Crus tibial surface

planta

under the heel

5 15 5 5 5 10 15 15 15 15 15 15 15 10 30 10

99

in front

20 45 60

10

10

Attention will be drawn to the fact that, with the exception of the last two regions, where the thickness of the epidermis plays such an important part, all the shorter exposure times fall on the regions of the body which are daily covered with clothing. There is a very significant jump between these times and the times which I have found for the usually uncovered areas of the body, and as regards the places where the epidermal layer is particularly thick, the exposure times increase enormously. While the reaction on thin and sparsely pigmented skin occurs after a 5 second exposure, up to 1 hour of exposure is required to elicit a visible in planta reaction.

The cause of the eminent importance which the thickness of the epidermal layer has for the occurrence of the reaction is to be sought in the following circumstances: The ability of the spectral rays to produce a light reaction in the skin increases, on the whole, with the refractibility of the rays. Most of the visible rays are totally incapable of evoking any reaction in normal skin); only in the blue-violet and ultra-violet part of the spectrum do rays have this ability and the larger the quantity of the most refractive rays the light contains, the shorter the exposure time required for the reaction to occur. The concentrated electric light described above will therefore lose so many of the ultra-violet rays when passing through a thin glass plate that exposure for hours to produce a visible reaction, e.g. B. on the skin of the forearm is necessary. --- With the ability of the spectral rays to penetrate through the skin, on the other hand, it is the opposite, as I have shown in an earlier work?); the penetration ability decreases in the visible and ultra-violet part of the spectrum with the refraction of the rays, and the most refractive rays are already absorbed by the most superficial layer of the skin. – Is the skin therefore

1) SMALL POX, buckwheat sensitization. 2) "Notifications from FINSENS med. Lys Institute”, volume IV, 1903, p. 108.

provided with a comparatively thick epidermis, the ultra-violet rays will not penetrate at all into the vascular tissue, and if, nevertheless, a reaction occurs after a long and intense exposure, these rays of somewhat smaller wavelength must be ascribed.

It is a question, however, whether the thickness of the epidermis, in conjunction with the pigmentation, suffices to account for the very important difference which I found between the generally covered and the generally uncovered regions of the body. It's possible that the latter had become accustomed to the light, quite apart from the pigmentation

or that peculiar structural conditions in the skin, apart from the thickness of the epidermal layer, play a role in the difficulty of the light reaction to occur.

The exposure times mentioned above are of course in no way absolute - but only of a certain relative importance; they apply only to my skin - and, moreover, only to my skin at the time the experiments were made').

The predominantly frequent occurrence of sun erythema in spring alone shows that the sensitivity of the skin varies with the seasons, and the figures in the table below show how important individual characteristics can be in this regard.

With a number of subjects of different ages and sexes, I exposed a series of spots to corresponding spots on the volar surface of the left arm,

1) It must also be added that the numbers are not a measure of the strength of the light concentrated ad modum FINSEN, because the pressure glass, as mentioned, was placed at a point in the cone of rays where the intensity of the light was significantly lower than in the same Focus is.

in order to find the exposure times necessary for the occurrence of the minimum reaction in a manner similar to that mentioned above. The pressure glass was placed a little further out in the beam than in the earlier experiments, so that the light used was less powerful.

I found the following times:

As can be seen, the times vary from 20 to 80 seconds for the different subjects. Even if skin color was consistent with the shorter or longer reaction times in most cases, I must add that these could be quite different between two individuals in whom the nuances of skin color appeared to be the same.

On a leucoderma patch, minimal reaction occurred after exposure of a significantly shorter time than that necessary to evoke reaction in the surrounding skin. It is also a known fact that patients who have leukoderma spots on hands or face often suffer from light erythema on these spots in summer if the skin is not protected against the short-wave rays of light, e.g. B. is protected by a glove or veil. -- It is worth noting that the light reactions left no pigmentation on the leucoderma patches.

In comparative investigations of lamps for phototherapeutic use, the skin has often been used as a sensitometer by determining the shortest exposure times during which a reaction could be evoked in the skin with the light from the lamps in question. It goes without saying that such an investigation is of value only in cases where it is a matter of comparing qualitatively similar light. The above investigations also show that with photometric determinations of this kind one may only compare the exposure results within very limited skin areas on one and the same individual.

III.

Lupus cavi nasi.

A clinical investigation

from

professor dr medical Holger Mygind (Copenhagen).

I

In two previous papers I have reported the results obtained from examining the larynx and pharynx of 200 lupus patients. The patients came from FINSEN's Medical Light Institute, where they were being treated for lupus of the skin , and in the period July 1898 to February 1899 I had the opportunity to examine them. In the present work, it is now my task to present the results of my examination of the nasal cavity of these patients.

As already mentioned in the two earlier works, among the 200 patients suffering from lupus of the outer skin, there were 57 males and 143 females, who were distributed among the different age groups as follows:

1) Lupus vulgaris laryngeal. Arch. f. laryngology. Vol. X. Issue 1. Lupus vulgaris pharyngis. Just that. Vol. XIII. Issue 3.

3

.

11

20

9

4

I 2

10

Frequency. A total of 129 individuals were found among the above 200 lupus patients who had either lupus or characteristic scars or destruction caused by lupus in the cavum nasi proprium. Among these 129 patients, 36 were men and 93 were women. They were distributed among the different age groups as follows:

men women

Not 15 years old

3

Aged 15--19 years

13

- 24

23

25-29

30 – 34

35-39

40-44

3

45-49

4 50 and above

9

93 Among the lupus patients examined, no fewer than 64.5 pCt. were found who had either lupus or its consequences in the cavum nasi proprium, whereby it should be noted that the vestibulum nasi is of course not included in this region. For the sake of comparison, it should be mentioned at this point that BENDER'), whose study included 380 lupus patients, only

I

II

8th

2

1) About lupus of the mucous membranes. quarterly for dermatology and syphilis. Volume 15. 1888. P. 891.

30.3 pct. diagnosed lupus of the nasal mucosa among his patients; LELOIR) found only 20 pCt among 312 lupus patients. with lupus of the cavum nasi, and nic. HOLM?) states for the 106 patients he examined that “in more than half of them, the nasal mucosa was affected with lupus in addition to the outer nose. E. PONTOPPIDAN3) finally found 40 out of 100 lupus patients who suffered from "lupus in the nose".

In our patients from FINSEN's Medical Light Institute, intranasal lupus could be detected significantly more frequently than in previous investigations, and this fact can only be partially explained by the fact that in the first years after the establishment of the institute, very severe cases were the main focus of treatment. Rather, the main cause must undoubtedly be sought in the greater care with which the examination of the nasal cavity was undertaken in our patients; because the present series of examinations is certainly the first more extensive one that has been carried out by a doctor who is particularly familiar with the rhinological examination methods.

Gender. From the absolute numbers in the table above, it can be seen that intranasal lupus was more than twice as common in women as in men. In assessing this ratio, which has been so strongly emphasized by many earlier authors, the fact must be taken into account that among the patients of the Institute there were also twice as many females, which in turn is a consequence of the fact that lupus is double in general

I) Traité pratique etc. de la scrofulo-tuberculosis. Paris 1892, p. 151. 2) Lupus affections Forhold til scrofula. Kjöbenhavn 1877, p. 17.

3) Om Lupus, sarligt with H. 1. Sygdommens Väsen og Aetiologi 1876, p. Finsen's medical light institute.

X

as common in women as in men. However, if one considers the number of patients suffering from intranasal lupus in relation to the number of all female and male patients examined, it can be seen that the incidence of the condition is approximately equal in both sexes; the difference between the two percentages was 63.2 pCt. females and 65.0 pCt. Men is so insignificant that one can completely ignore it. Intranasal lupus differs in this respect from both pharyngeal and laryngeal lupus; for in the examination of the same 200 patients the males predominated in pharyngeal lupus, but the females in laryngeal lupus.

Age. In my previous work I have shown that lupus is relatively more common in the pharynx and larynx in the younger than in the older age groups. In fact, the difference is quite significant; for these two forms of mucosal lupus were found relatively twice as frequently in individuals aged up to 25 years of age as in individuals of older years. I remarked in the papers mentioned that one reason for this relationship might be that the lupus affecting the mucous membranes of the larynx and pharynx is the expression of a more serious form of lupus, a form that endangers the life of the patient abbreviated so that individuals with pharyngeal or laryngeal lupus are less commonly found among the older age groups.

The overview on p. 32 sheds light on this relationship in relation to lupus cavi nasi. From this it follows that intranasal lupus was found just as frequently in individuals who had not yet reached the age of twenty-five as in those who had already passed this age limit. In accordance with the above, this fact can be interpreted as an indication that lupus of the nasal mucosa is a complication which does not endanger the patient's life to the same degree as lupus affecting the deeper parts of the upper airways.

other causes. Since experience has shown that intranasal lupus is most commonly associated with lupus of the outer skin, it is reasonable to assume that the outer skin, the actual locus electus of lupus infection, was first affected by lupus, so that intranasal lupus is secondary . The correctness of this assumption is supported by the fact that in only 13 of our cases of intranasal lupus did the external nose show neither lupus nodules nor other sequelae of lupus (scars, destruction), and in none of these cases was the facial skin free. The assumption that intranasal lupus is usually of a secondary nature is further confirmed by the fact that the affection of the nasal cavity was in most cases not very widespread, and appeared to be indolent and benign in nature, while the external lupus affection was correct widespread and quite destructive in nature: this may indicate that lupus of the outer skin is the older one. However, various things can be done about this

. object. In the first place, one often sees that the lupus process destroys the outer skin very quickly, while intranasal lupus, on the other hand, can not infrequently persist for years without producing any destruction, except for a generally minor perforation of the septum, which is known to be very slight, yes perforated even in completely benign ulcerative processes.

Secondly, it should be noted that lupus actually occurs primarily on the nasal mucosa and can even persist for a long time exclusively localized at this point"). The present study was not able to prove such a relationship, although it should be noted that the material on on which the investigation is based, included almost exclusively those patients who had suffered from the affection for years, so that it was not easy to determine where the condition first appeared.Since the material of the present investigation was collected, the conditions at the Light Institute have changed has changed to some extent in this regard, so that, as reported by the institute's senior physician, Dr. FORCHHAMMER?), the number of fresh cases treated has increased significantly in the years that followed know the answer. In which direction Dr. FORCHHAMME R's experience is easily recognized from a statement in the communications mentioned; he remarks (p. 14) that lupus often develops first on the mucous membranes and then secondarily attacks the outer skin. Other modern investigators have expressed similar views, although it should be noted that many of them unequivocally include the vestibule in the nasal cavity. One may well do so, of course, but under no circumstances should vestibular lupus be called lupus of the nasal mucosa, and the question here is whether it was the nasal mucosa that was primarily affected. Future investigations may be able to balance somewhat the divergence between the two seemingly different views, perhaps by showing that the primary affection is often found in the zone that marks the transition between the skin of the vestibule and the mucous membrane of the nasal cavity forms.

1) Most of the physicians particularly concerned with rhinology state that primary intranasal lupus is observed very rarely. Even a specialist as experienced as Moritz Schmidi observed only a single case of this kind (The diseases of the upper airways. 1894. p. 331). However, I usually see 1-2 cases every year.

2) The results of light treatment in our first 800 cases of lupus vulgaris. Communications from the Finsen Institute. Vol. VI.

The localization of the lupus affection in the nasal cavity. On closer investigation of this relation it turns out that the different portions of the nasal cavity are not all equally affected by lupus; the various sections also behave very differently in relation to the course and consequences of the disease.

Nares. The entrances to the nasal cavity, the nares, are extremely often the site of lupus; among our 129 patients there were only seven who had no lupus and no sequelae of it in the nostrils. The boundaries of the nostrils formed by the ala nasi were particularly frequently affected by lupus. In very many of these cases, however, the lupus process had already come to an end, leaving behind scars and destruction; in some cases the ala nasi was completely destroyed. In cases of this kind, which, moreover, have no appearance characteristic of lupus, there is a quite conspicuous deformity of the external nose; namely, if one looks at it in profile, a direct view opens up into the anterior and lower part of the septum. On the other hand, some partial destruction, accompanying cicatricial contraction, produces a minor deformity, which I have not observed in any other ulcerative processes of the nostrils, but which was found in eight of our patients. The same consists of an appropriate indentation in the free edge of the ala. The deepest point of the indentation is most commonly where the ala meets the nasal apex, but the scar-like notch may extend all the way up the anterior apex. Very often I found the anterior border of the nares formed by the apex nasi covered with lupus nodules or scars, sometimes even destroyed, and the latter process not infrequently extended far forward and was quite deep. In no fewer than 30 patients the destruction was so extensive that the apex had to be considered as completely lost. The border of the nares formed by the septum cutaneousum was least rarely affected. Lupus nodules as well as scars and destruction were found there. The scars were often spread over the entire cutaneous septum and the septum had been visibly shortened as a result. In some cases the shortening was so significant that the tip of the nose had been drawn down in a conspicuous manner ("hawk nose", "parrot nose"). The scar-like changed septum was often thickened and wide. In a few cases the septum cutaneum was completely destroyed, so that the outer nose hung limply in front of the nostrils:

In addition to the scarring and destruction described above, changes in the shape of the nares are very common. The most common finding is narrowing of the nostrils. The same often comes from this

. The result is that scars are formed evenly from all sides, which in extreme cases gives the nostrils the shape of a loophole. Frequently, however, the narrowing is more pronounced in one direction than the other, so that the nostril becomes oval, usually transverse, pear-shaped, or in extreme cases is converted into a gap. If the cicatricial contraction is more irregular, the two nares may be drawn towards each other, sometimes so much that one opening may be pushed a little beyond the other. In rare cases one finds the nostrils or one of them completely closed by the scar formation; but among our patients only one such case was detected on examination.

Enlargement of the nostrils caused by destruction of the borders of the nares, and especially by destruction of the cutaneous septum and the anterior and inferior parts of the septum, is not uncommon. If the anterior inferior part of the septum is destroyed, the nares together form a large round or triangular opening, the apex of which is directed upwards, and at the base of which one sees the thickened anterior border of the septum cartilagineum (9 cases).

The fact that cicatricial formations and destructions in and around the nostrils were found so extraordinarily frequently in our patients, while on the other hand nodule formation there was relatively seldom, certainly points to the fact that the lupus affection occurring in this region is a rapid one history. At the same time, the described destructions indicate that the lupous process at this point is very inclined to go deeper, whereby the disfiguring lupous stigmata arise, which

then follow the individual throughout life. In and of themselves, these stigmata excepted one mentioned earlier

supposed to have no characteristic peculiar to lupus; but in this country one sees extremely seldom that malformations like the ones mentioned are caused by other ulcerative processes, such as e.g. As syphilis and leprosy caused.

Vestibule. Besides the lupus affections mentioned above, which appear chiefly on the nares, there were two others in the vestibule, localized on the lower parts, which deserve discussion. One is the formation of lupus nodules in the superior anterior angle of the vestibule, where the medial and lateral surfaces meet. We found this nodule formation in 16 of our 129 patients suffering from intranasal lupus, thus in 12.4 pct.; in five other patients scars were found as a result of such nodule formation. The nodules were small, flattened, rather indolent, with superficial ulceration secreting a very small quantity of mucous pus; the scars left behind were most often recognized as fine lines of connective tissue. This affection is easily overlooked on examination; for sometimes the knots do not protrude much, and sometimes they can only be observed when the angle is widened. For this purpose, the two angular surfaces are clamped firmly apart by means of the dilator, while at the same time the patient bends his head strongly backwards. The other affection consists of a peculiar cicatricial plate originating at the point where the floor of the vestibule meets the floor of the nasal cavity. It rises in the frontal plan and ends at the top with a crescent-shaped cutout. Among our patients this plaque was found in 21, ie in 16.2 pCt. found, usually bilateral. When such a cicatricial plate is present, its anterior surface merges directly with the floor of the vestibule, and this floor then assumes a very oblique position in the direction superior and posterior. In very marked cases, therefore, the floor of the vestibule loses its normal horizontal position and assumes an almost entirely frontal position, so that the floor presents itself very sharply on direct vision. The cicatricial plate, which is most commonly quite thick and fibrous, while its upper excised free edge is quite sharply defined, is quite sharply separated from the posterior portion, the anterior part of the floor of the nasal cavity, so that on probing one often sees the gives the impression that the probe suddenly slid down into a deep pit. On both sides the scar plate goes into the lateral resp. the medial border of the transition from the vestibulum to the cavum nasi, so that it seems to hang in these two parts. In pronounced cases the cicatricial plate had greatly narrowed the entrance to the cavum nasi proprium; the entrance to the nasal cavity can therefore be narrowed in two places, namely at the nares and at the transition from the vestibulum to the actual nasal cavity. The scar plate described, which is characteristic of lupus, is probably caused by the fact that a nodule forms at the transition from the vestibule to the floor of the nasal cavity, ulcerating and cicatricing. The latter process then produces a contraction which cannot act upon the floor of the nasal cavity, because it is connected by firm connective tissue to the underlying bone; on the other hand, she is very well able to

to raise the floor of the vestibule, because it lacks a firm foundation.

When we now proceed to the discussion of the lupus affection occurring in the cavum nasi proprium, it is most expedient to treat each region of this cavity separately; for even in the actual nasal cavity one finds the individual sections unequally often affected by lupus, and the course of the lupus process is very different in the different regions.

nasal septum. The septum is to be regarded as the locus electus of lupous intranasal affection; for among our 129 patients there were only 35 whose nasal septum showed no signs of lupus and no sequelae of it. Consequently, at 77.3 pCt. among patients with intranasal lupus and at 47.0 pCt. affected the septum among all 200 lupus patients. The disease was almost always located in the anterior part of the septum, and in only one case had the bony base of the septum been destroyed by the lupous affection. All previous investigations have found the same result in relation to the latter relation, and in it we have an important differential-diagnostic clue in relation to syphilis; for syphilis is very apt to destroy the bony foundation of the septum. LELOIR ") has to give an example of the fact that the lupus affection can also cause a disease of the osseous basis of the nasal septum in exceptional cases, and this is accompanied by our above-mentioned case; because digital exploration turned out that the rear part of the septum osseum was absent. The palpation of the remaining portion was attended with such great difficulty that one could not gain a definite idea of its condition. The septum cartilagineum was not destroyed, but on both sides the nasal cavity was almost completely filled with lupoid nodules; the same originated partly on the lateral and partly on the medial surface, and continued as far posteriorly as the eye could survey the cavity.The posterior ends of the two inferior conchae were much reduced, probably owing to destruction of the bony tissue , and the mucous membrane was scar-like at this point.These proportions However, all of these could only be proven by digital exploration; for the rhinoscopia posterior could not be undertaken.

1) I.c. p. 158.

In a relatively small number of cases

24 in all, ie 18.9 pct. among all cases of intranasal lupus - the detected lupous affection consisted exclusively of nodule formation on the mucosa of the septum; in the remaining cases, on the other hand, destruction of the underlying floor, or a perforation in connection with scar formation, or scar formation on the mucous membrane without perforation was detected in addition to the formation of nodules. However, the latter ratio was found in only one patient; Knots were found on one side, and fine, slightly prominent scar lines on the other, but no perforation.

The nodule formation demonstrated on examination was unilateral in only two cases; in all the other cases it was mutual, a relationship which essentially promotes the destruction of the quadrangular cartilage, because nutrition is then disturbed on both sides.

Exceptionally, however, it certainly happens that the lupus affection migrates from one side through a perforation of the cartilage, so that the affection thus becomes bilateral.

The lupus nodules located at the nasal septum were usually small and not grossly luxuriant; nor did they give rise to any protruding discharge of mucous pus. In some cases the pus tended to dry up and crust.

In only one case were the nodules protruding and forming a significant granulation mass, a so-called lupoma, which filled part of the corresponding nasal cavity. As a rule, the nodules did not spread much beyond the surface and were usually located at the anterior and inferior portions of the septum.

Thus, while the lupus nodules do not generally spread much beyond the surface, it is, as before mentioned, very apt to go deep, and as the mucous membrane of the anterior and inferior parts of the septum is but thin, so A loss of substance of the cartilago quadrangularis occurs very easily, ie a perforation of the septum forms. Perforation was found in as many as 58 (+5.0 pCt.) among our 129 patients suffering from intranasal lupus, and this percentage corresponds to 29.0 pCt. among all 200 patients from FINSENS medical light institute). Only exceptionally (in 18 cases) were knots found on the edge bordering the perforation; usually the edge was scar-like. Incidentally had

1) However, it should be noted here that the perforations of the septum also included cases in which the lupous ulceration process had gnawed the anterior free edge of the exposed quadrangular cartilage, nine cases in all.

the perforation of the septum nasi to show the following conditions: They are found almost exclusively

at the very front of the septum, often so far forward that there can be no question of a perforation of the quadrangular cartilage, but rather a cutout in the anterior edge of the cartilage. The anterior boundary of the perforation is often not formed by a cartilage bridge at all, but by the integuments of the bridge of the nose and the septum cutaneum, and thus exclusively by soft tissue. Such a marginal perforation was detected in 30 of the cases examined. In nine cases the integuments of the nasal dorsum were absent (see p. 44, n.d.), and the gnawed anterior border of the quadrangular cartilage was exposed. In the remaining cases, the anterior boundary of the perforation was formed by a cartilaginous bridge, most often very narrow. The size of the perforations varied greatly; the smallest appeared as small, punctiform openings, while the largest encompassed almost the entire cartilage. However, the extreme sizes were found very rarely. As a rule, the perforations, which were always measured, measured i 2 cm. in height; in the front-to-back direction, they were slightly smaller. In terms of shape, they were most often oval, not infrequently slit-shaped, sometimes even circular. In only two cases had the destruction of the cartilaginous septum produced a malformation of the external nose; the same had acquired a hint of a "Lorgnette nose". The peculiarity of this form consists, as is well known, in the fact that the part of the external nose lying below the Apertura pyriformis sinks in, so that along the boundary of the Apertura pyriformis a more or less deep furrow is formed. depending on how the tip of the nose has pushed up more or less below the free edge of the aperture. The manner in which this nasal deformity arises is not yet fully understood. In my opinion it is not due to the loss of substance in the septum, but is caused by the retraction of the external nose caused by the scar formation.' I find confirmation of this view in the fact that the same deformity may also occur in consequence of an abscess formation in the septum which has not produced a perforation, and in the fact that the Perforations in the above two cases were very small, while around the same one very significant scarring occurred.

Finally, it should be noted that in two cases I found one between the septum cartilagineum and the concha inf. on one side of the nasal cavity. resp. found a stretched, not particularly strong bridge of scars in the concha media.

The floor of the cavum nasi. In this region, too, the lupous process was localized chiefly in the anterior part of the nasal cavity. It could not be shown how far back the suffering extended in these cases; for the lupus nodules on the anterior parts of the floor of the cavum nasi, as a rule, made it considerably more difficult to see the posterior parts of the cavity. However, I did not observe a single case in which I could be certain that the condition had crossed the line between the anterior third and the middle of the floor.

The affection in 36 cases consisted entirely of nodule formation, and the nodules were general

1) See also MYGINT): Die Krankh. the upper airways. p. 82.

large and heavily luxurious. I observed scar formation in only one case. In no case could a destruction of the underlying bone be detected. Nodule formation was unilateral in only five cases.

Inferior nasal meatus. In this section, lump formation was noted in 32 cases and scar formation in one case. The affection was unilateral in four cases. A destruction of the bony basis was not proven.

inferior concha. The mucous membrane of the concha inf. in 80 cases, ie 62.0 pct., gave rise to lupoid nodules; but visible scars were only found in three cases. This peculiar relationship is undoubtedly based on the fact that experience has shown that the lupus nodules can persist for years in this part of the mucous membrane without spreading either over the surface or going into the depths; moreover, the scars caused by lupus are usually not visible in this region. Incidentally, those on the concha have inf. localized nodules often have a peculiarly flat and flaccid appearance, and as they are often very small and indolent, they tend to escape attention. However, if one stimulates the part of the mucous membrane to be examined with a probe, one easily recognizes the nodules; because the resulting increase in blood supply causes the nodules to become more prominent, and it is not uncommon to notice with astonishment that an apparently smooth area of mucous membrane covered with a little mucopus turns out to be a nodular surface of lupus after this treatment. Only in 14 cases was the lupus affection on the inferior concha unilateral.

It is often difficult to decide how far back a lupous condition of the concha inf. itself

extends; for not infrequently the view of lupus nodes on the anterior parts of the concha inf. or aggravated by narrowing of the nostrils, etc., and frequently there are lupus ulcers at the corners of the mouth, lupus nodules of the soft palate, etc., scarring of the pharynx, and the like. Conditions obstructing the posterior rhinoscopia. Various reasons lead me to assume that among the 80 patients in question who suffered from the concha inf. presented lupous affection, in 67 the lupous nodules had spread only to the anterior third of the concha, in 13 cases they extended to the middle or somewhat beyond it, and in five cases they were quite to the posterior end of the concha inferior spread.

In a few cases I found destruction of the bony inferior concha; however, she never was. sometimes pronounced and consisted mainly of a gnawing at the anterior or posterior end of the bone. Most often (four times) the front end was gnawed; I found the rear end affected in this way three times.

In a single case, as mentioned on p. 46, there was a thin bridge of scars between the anterior part of the concha inf. and stretched out the septum.

middle meatus. I cannot state with certainty how frequently this region provided the seat for lupus formations; for, for the reasons previously mentioned, she most frequently eluded examination. It seemed to me, however, as if the lupus affection only exceptionally extended from the inferior concha to the meatus medius.

median concha. I found lupus nodules on the mucous membrane of the concha media in 16 cases; in most cases they were localized on the anterior parts of the concha. The suffering was mutual in all cases. There were no scars or destruction of the bony foundation. In one case a scar bridge was found between the anterior end of the concha media and the septum.

Choanae. From the above account it is evident that the choanae are rarely found to be affected in patients with intranasal lupus, and the communication also sheds light on the manner in which lupus affects this region. In one case, as already mentioned, the septum osseum was destroyed, the posterior part of it being missing (see p. 32). In three cases the posterior end of the concha inf. owing to loss of substance of the bony part, and the mucous membrane was scar-like. In addition, in two cases lupous nodules were found on the mucous membrane at the posterior end of the inferior concha. Lupous affections of the choanae were detected in only five cases (in the first of the cases showing destruction of the posterior part of the septum, the posterior end of the inferior conchae was also destroyed). Only in three of these cases were there also lupus scars in the rhinopharynx, but in no case was this region the seat of lupus nodules. This ratio indicates, as I have shown elsewhere 1), that lupus rarely spreads directly from the nasal cavity to the mucous membrane of the nasopharynx.

IV

Studies on the action of certain light radiate to sensitized tissue.

Of

Rud. Kolster.

(With i panel.)

During a short stay in Copenhagen last summer, through the gracious courtesy of the late Professor NR FINSEN at the Lys Institute, I was not only given the opportunity to conduct a series of experiments, but also all the material and the necessary assistance were made available.

My gratitude for this, as well as that which I extend to his representative, Dr. H. FORCHHAMMER, I would like to express my gratitude to my special assistant, Dr. H. JANSEN, who gave me his rich experience and help in the most self-sacrificing way.

That the rays of light have a great influence on living organisms, and that the blocking off or intensification of certain pathological processes is followed by a favorable influence, so that normal or at least approximately normal conditions reappear, is a finding which Professor NR FINSEX has laboriously achieved

to

and years of work has acquired his contemporaries and needs no further interpretation here. On the other hand, some detailed research is still necessary, partly to explain the results already obtained, partly also to perfect them and to expand the field of light therapy. In order to arrive at this end we must first acquire an accurate knowledge of the changes which arise in normal organs after exposure to light, and of the circumstances which weaken or aggravate the resulting process. Since we know, however, that light is composed of many different rays , we must try, in order to achieve the best possible result, to gain knowledge of the effects of these different individual rays

to win. We must try to determine under what circumstances their action best occurs or is excluded, in order to be able to choose the most suitable combination of the different rays in each individual case and to facilitate their action. The aim of the present study is to make a histological contribution in this regard.

deliver. Such investigations are only available in small numbers and incomplete form.

That the different rays, which show us the division of light through a glass prism, and which are usually named according to their color, also act differently on normal and pathological processes occurring in living organisms, has been indicated in many places by experimental morphology. However, these observations only acquired therapeutic importance when Prof. FINSEN proved that blocking off all light rays, with the exception of the red ones, prevented the suppuration process in the smallpox and thereby also the scarring which tended to occur as a result of this disease.

From that time on numerous works were published on the different importance of the different parts of the spectrum for the life processes of living organisms. These investigations have already been compiled in earlier publications by the "Lysinstitute" so that it seems unnecessary to cite them again here, all the more so since the various light sources used actually preclude a more precise comparison. This is only possible when all the circumstances that influence the light source can be precisely determined and therefore probably only when artificial light is used. The value for drawing general conclusions is greatest when the light source was the same in the various experiments, and I therefore feel justified in excluding from the brief historical notes that follow the majority of the papers which were not assisted by Prof. FINSEN for concentrated light constructed for therapeutic purposes , ie the light source which was used in my experiments. With the same apparatus and under

and by excluding the heat by flushing the test cultures with cold water, BIE!) has demonstrated that all rays of the spectrum, beginning with the red ones, can inhibit the growth of B prodigiosus and even kill it. However, the latter property could not be proved very strictly for the red rays.

The inhibitory effect increases with the refraction exponent and suddenly increases with the onset of the violet

1) Bie, Undersögelser om Virkningen af Spektrets forskellige Afdelinger på Bacteriers Udvikling. Medd. from FINSENS med. Lys Institute, I, 1899.

rays, so that it is justifiable to ascribe the greatest influence in this respect to the violet and ultraviolet rays.

The various rays examined were isolated in such a way that a light filter was placed between the light source and the culture, which let through only those rays whose effect was to be examined.

BANG 1) repeated these experiments using a different experimental design. Instead of using a light filter that allowed only certain rays to pass through, he separated the light into its individual parts by means of a prism and exposed the cultures to the different parts of the spectrum thus obtained. In essence, BANG confirmed the earlier results obtained by Bie, but also showed that there were two maxima in the ultraviolet part.

While these experiments clearly show that an actual bactericidal effect is mainly exerted by the violet rays and that the others are significantly less important in this respect, investigations carried out by BUSCK 2) show that the situation is reversed when the penetration force is compared to that of living beings tissues is considered. BUSCK repeated earlier experiments by Prof. FINSEN using the light source mentioned above and showed that the penetrating power of the light rays increases from the violet to the red part of the spectrum, so that this property is at its maximum.

from

I) BANG, Om Fordelingen af bacteria-threatening Straaler i Kulbuelysets spectrum. Medd. from FINSENS med. Lys Institute, IX, 1904.

2) BUSCK, Om de forskellige Spektralstraalers relative Penetrationscosce overfor dyrisk Vaev. Medd. from FINSENS med. Lys Institute, V, 1903.

Attempts to utilize the bactericidal and chemically active parts of the spectrum as much as possible resulted in the construction of light sources which were particularly rich in the chemically highly active parts. but little deep penetrating violet rays were. However, as is generally acknowledged, they have not proven themselves. This depends largely on their only superficial influence. It was therefore natural that efforts were made to make therapeutic use of the rays, which under normal circumstances have only a weak chemical effect but penetrate deeply, and which are present in large quantities in Finsen's apparatus for concentrated light.

It did not seem impossible to achieve results in the field of therapy, since in another field, that of photography, it was possible to make these rays effective.

TAPPEINER and his students have subjected the effects of fluorescent substances to close examination under simultaneous illumination and their work also includes the first observations of the effects of light on sensitized living tissue. RAAB observed that the ears of white mice injected with eosin developed necrosis from exposure to sunlight. The extensive studies of fluorescent substances gradually prompted

TAPPEINER and his students to carry out therapeutic experiments, which were initially carried out in such a way that the diseased parts of the skin were coated with sensitizing solutions and then exposed to the effects of sunlight. Later, the experimental design was modified to use artificial light, heat-absorbing filters, and sometimes subcutaneous injections of the sensitizing agent.

But before these therapeutic experiments were published, DREYER, based on previously published work by TAPPEINER's laboratory, had devoted a thorough study to the influence of sensitizing substances on bacteria and in some cases also on living tissue, and published his results. These DREYER investigations show with absolute certainty that sensitized infusoria "Nassula" and bacteria "B-prodigiosus" are destroyed by exposure to light much more quickly than unsensitized ones. By using different light filters , DREYER was able to further show that this was due to the fact that under these conditions long-wavelength rays alone produced a considerably stronger effect than all the spectral rays together on unsensitized infusoria and bacteria.In all his experiments the influence of heat was eliminated by flushing the cultures with cold water.

It is of great importance that DREYER was able to show that the long-wave rays retained their influence on sensitized infusoria, although they had to pass through quite thick layers of skin. Sensitized nassula cultures were destroyed in 20 seconds, despite the fact that the rays had penetrated a skin layer of 1.25 mm, while an equal effect on unsensitized ones could only be achieved with an exposure lasting 60 minutes. Even when the skin layer thickness was increased to 4.25 mm, the same sensitized cultures could still be killed by a 400 second exposure.

Medd.

1) DREYER, Sensitization of microorganisms and dysriskic vessels. from FINSENS med. Lys Institute, VII, 1903.

From DREYER's experiments it was definitely evident that impregnation of these test objects with sensitizing dyes gives the penetrating rays an effect which is equivalent to that exerted on the more superficial layers of the same cultures by rays usually described as chemically active, and further that this effect is significant is more intense.

In experiments on the influence of concentrated light on living animal tissue, especially the frog tongue, DREYER and JANSEN determined the following through histological examination.

“ First there is vasodilatation and simultaneous hyperaemia, followed by abundant serous infiltration and thrombus formation in the superficial capillaries and smaller vessels

Only later does a relatively small amount of migration of white blood cells from the deeper, non-thrombosed vessels begin. At the same time, the restoration of normal conditions begins, which is completed in the course of about a week.

The main peculiarity of the light effect just described is its superficial location and mild progression.”

Similar experiments after prior sensitization and using only long-wave light rays, which pass through a light filter of 5 percent monochromatic potassium, had given DREYER 2) the following deviating result, which, however, is not based on more precise histological examination .

“ The exposed area corresponded to a strong edematous swelling, vasodilatation and thrombosis of

touch

1) DREYER and JANSEN, Om Lysets Indvirkning paa dyriske Vaef. Medd. from FINSENS med. Lys Institute, IX.

2) DREYER, I. c.

Capillaries and smaller vessels, both on the surface of the tongue and on the capillary side turned away from the light. The following day thrombi also appeared in the larger vessels throughout the thickness of the tongue and some cell migration.

The strange results that DREYER had obtained in his examinations of sensitized tissues prompted a control examination in the dermatological clinic in Breslau, where Dr. HALBERSTAEDTER carried out a series of experiments at the suggestion of Prof. NEISSER 1). However, judging from the description, the tests were arranged differently than by DREYER. In HALBERSTAEDTER there is no information about the exclusion of the heat effect, as well as about the type of rays used, so that one is led to assume that the entire radiant mass of the related FINSENREYX lamp and the heat produced by it coincide with that taken for the experiments guinea pigs, but sometimes the ultraviolet rays were switched off by interposing glass compressors.

Histological examination of the skin sensitized by subcutaneous injection of a 1% erytrosine solution showed developing edema, vasodilatation, thrombus formation along with diapedesis of red blood cells, and later also of leukocytes. If exposure was extended to 60 to 40 minutes, central necrosis developed. Particularly noteworthy is the deep exposure, which is possible after prior sensitization, in contrast to the superficial exposure to light on non-sensitized skin.

1) NEISSER and HALBERSTAEDTER, reports on light treatment according to DREYER. German med. Weekly, Vol. XXX, No. 8, 1904.

Since there are no further histological studies on the changes achieved, and there are many gaps in those of DREYER and HALBERSTAEDTER, I thought it appropriate to undertake a new study of the processes by which the sensitized skin reacted to the effects of the usual chemically inactive skin designated rays of long wavelength reacts.

White mice were used in my experiments, the hair of which was clipped short at the site chosen for exposure, care being taken to ensure that the epidermis remained undamaged.

As a sensitizer, a sterilized solution of erytrosine in physiological saline was used. Through preparatory experiments I found that white mice without any visible harmful effects (observation period two weeks) received an injection of 2 ccm i per cent. erytrosine solution

2 intraperitoneally and twice as much subcutaneously if the injections are made in two injections with an hour interval. However, since such large doses should not be used, a more detailed examination of the mice's resistance to erytrosine seemed unnecessary. For the experiments themselves, i cem i proz. erytrosine

I solution taken, which was injected subcutaneously into the center of the close-cropped spot. This happened 3 to 4 hours before the exposure and during this time the mice had turned red, especially on the ears. At the same time, the faeces and urine had also turned red. Despite all caution, individual hairs were wetted by the dye solution, a circumstance which, as mentioned below, was of a certain importance.

The well-known apparatus designed by Prof. FINSEN for treatment with concentrated light served as the light source.

The spot chosen for exposure was placed perpendicular to the cone of light, 7-8 cm from the distal lens of the concentrating apparatus. Here the bundle of rays had a diameter of about 19 mm.

Since I intended this time to study only the rays usually described as chemically inactive, a light filter was placed between the last lens of the concentrating apparatus and the experimental animal, which had a 5 per cent. solution of monochromatic potash contained. Only the red, orange, yellow, and yellow-green rays could work through it.

Exposure always lasted 20 minutes and was usually done only once on the same animal. In very few cases, after a few days, the same spot was exposed to a second, equally long exposure.

To eliminate the influence of heat, the exposed spot was flushed with tap water while the experiment was in progress. However, since I feared that cooling for 20 minutes might be harmful to the small test animals, after a few preliminary experiments this was restricted to the exposed spot alone in the following manner.

The experimental animal was fixed to a lead plate by tying its feet so that the spot intended for exposure corresponded to a hole in the plate whose diameter was a little over 2 cm It was not difficult to bring the edge of the plate hole so close to the experimental animal that the jet of water wetted only the part of the skin corresponding to the hole. After the end of the experiment, this always showed a temperature below that of the surroundings.

was.

To have a control preparation, one mouse was exposed without prior sensitization and sacrificed after 24 hours. The sections, however, showed no particular deviations from normal conditions. Further, it was exposed once without cooling. During the exposure, a macroscopically visible and palpable edema developed, which was absent in the other sensitized patients and only developed later when the exposure was extended to 60 minutes. The same therefore had to be regarded as a pure heat effect, which, as hoped, was ruled out by the flushing and consequently not examined in more detail.

In order to be able to judge with certainty whether erytrosine alone could produce similar effects, mice were examined for different lengths of time after sensitization without subsequent exposure. The results here were negative.

All sensitized animals were kept protected from strong daylight at all times. Since the time of my stay in Copenhagen was very limited, fixatives, after which a longer washout was necessary, could not be used and CARNOY's mixture (6 parts absolute alcohol, 3 parts chloroform, 1 part glacial acetic acid) was therefore used for fixation. The preparations remained in it for 1 hour and were then immersed in alcohol. Section. The pieces of hide, however, became very hard as a result, but this inconvenience was largely remedied by placing the pieces in cedar oil for a few days.

Finally, the preparations were embedded in paraffin using chloroform. This happened under the air pump in the manner I have previously indicated.

For other similar investigations I would no longer recommend the method of fixation chosen, despite its simplicity and great usefulness for depicting finer structures, since it makes specific hemoglobin staining difficult, even though good, useful preparations can be obtained by various tricks. Other fixative liquids are preferable.

From the material obtained from the various experiments I separated out everything that had not been obtained by deliberate killing at specific times and fixed immediately. (Unfortunately, initially several of the small experimental animals were injured and died when I was not in the laboratory.) Only one exception has been made, and that for a mouse, which in all probability died about 12 hours after exposure. The fixation happened a few hours after death. The material at my disposal corresponded to the following times after completion of the experiment: approximately 12 hours, 24 hours, 2, 3, 4 and 6 days. In addition, two experiments were sometimes carried out on the same animal, corresponding to 3 days after the first and 24 hours after the second, 6 days after the first and 4 days after the second and 7 days after the first and 5 days after the second exposure.

After completion of the exposure, the exposed spot, with the exception of the above-mentioned local cooling, became sharply contrasted with the surroundings

paleness observed.

On the other hand, there was no edema. After 24 hours, however, the external puncture site had assumed the same red color as before exposure, and which was similar to that revealed by other sites of the epidermis that had been inadvertently wetted by the stain solution. This color persisted during fixing, so it was immediately noticeable on untinged sections.

At this time, a slight edema could also be seen macroscopically. Likewise, the mice were very sensitive to pressure at these sites. However, these two symptoms disappeared in the next 24 hours.

The experiments exercised on the general well-being of the animals if 1. a. executed, no major impact. They were shy and a bit cold, but after an hour they were lively again and showed appetite. The only sign of the experiment that had been carried out was the red colored faeces and red urine, which were observed for a few days.

In order to facilitate the comparison with normal conditions when evaluating the results of the microscopic examination of the exposed skin areas, I have shown a section through the corresponding skin area of an unexposed animal in Fig. I, which preparation was fixed and stained in the same way as the experimentally obtained.

Twelve hours after the exposure has been completed, the sections through the exposed piece already show quite significant changes. These are not the same everywhere, especially the epithelium shows a

1) KOLSTER, paraffin embedding in a vacuum. Journal for scientific microscopy 1901.

very different appearance in different places. By comparison with untinged sections it is easy to show that the sites which accidentally acquired an external red coloration from the injection of erytrosine also show significant superficial necroses, while the epithelium was otherwise well preserved.

In these latter places, fig. 2, a considerably looser condition of the subepithelial connective tissue appeared, so that this occupied a much wider space than under normal conditions, fig. The connective tissue tracts, which are normally quite firm and thick and run more or less parallel to the surface, are broken up into a rather fine network of fibers which show a pure acid fuchsin staining ?). Relatively abundant cells, most of which are polynuclear leukocytes, are found in the meshes of the network. Such are found in the normal control preparations only exceptionally. Isolated mast cells in normal abundance are found. Emigrated erythrocytes are completely absent.

The vessels are greatly dilated and filled with blood. Within these, polynuclear leukocytes are very abundant. The endothelium shows only very slight changes, but since the piece of skin examined was not fixed until a few hours after the death of the experimental animal, I omit them here.

The superficial muscle layer, Fig. 2c, has lost its uniform, compact nature, Fig. 1c. Instead of distinct muscle bundles, there are scattered, individual muscle fibers surrounded by numerous, polynuclear leukocytes.

The deeper layers, designated b and c, showed nowhere abnormal phenomena.

The epithelium was either full around the puncture canal and at the other sites which had received superficial erytrosine staining during sensitization

1) The staining was mostly hematoxylin and VAN GIESon's post-staining

constantly detached or shriveled together with the underlying layers (Fig. 1a, b and c) into a narrow, barely discernible layer. Where there was a defect, it was usually confined to the epithelium alone, while the superficial parts of the lower layers presented the same appearance as where no epithelium was absent. Nuclear staining could never be achieved at these sites.

Twenty-four hours after exposure we find the following at the sites which show preserved epithelium (ie where superficial staining had not taken place): In individual smaller areas the subepithelial connective tissue is still dissolved into a fine meshwork. In general, however, the individual fibers no longer stand out so clearly, and the interstices are no longer quite so clear, although the width of the layer has increased. One gets the impression of a stronger swelling that has taken place, as a result of which the significantly more numerous, polynuclear leukocytes have been arranged into curved and branched lines in the sections, Fig. 3.

The hair follicles and sebaceous glands also behave differently. Some have shrunk to a homogeneous, brown-colored mass, while the majority appear normal.

In the papillae, just below the epithelium, small accumulations of polynuclear leucocytes and, in their vicinity, somewhat increased mitoses in the epithelium are quite often found, from which the latter a fairly thick, keratinized layer has shed or has already detached in places.

The vessels are much more dilated than in the preparation previously described, and contain almost over

all polynuclear leukocytes and erythrocytes, approximately in equal proportion. Where the latter are in excess, the latter mostly occupy a peripheral position, and are also found close-fitting in the walls of the vessels and their exterior. The vascular endothelium is not quite regular. In places, the nuclei are far apart from each other, in places individual ones appear clumped, while adjacent ones can be strikingly large. There is no diapedesis of erythrocytes or actual bleeding.

The superficial muscle layer, Fig. 3c, is hardly recognizable. The same, as well as the adjacent parts of the subepithelial connective tissue, are replaced by uniform accumulations of polynuclear leukocytes, between which red-stained connective tissue fibers and cross-sections of individual muscle fibers are found. The fact that only very few of the latter are still preserved is immediately apparent when comparing them with normal preparations.

The underlying connective tissue here also shows severe swelling and copious infiltration of polynuclear leukocytes. Smaller, similar infiltrations are also often found in the deeper muscles, where the muscle bundles have often dissolved.

In the places where the epithelium and the superficial layers of skin were red, there are defects of different depths and changes of the following kind:

The epithelium is often missing or has at least shrunk to a thin layer within which the individual cell components can no longer be distinguished, Fig. 4a.

Similarly, the deeper layers have also shrunk, but here, at least, releases a. Finsens Medical Light Institute.

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wise still a nuclear staining can be obtained. The extent of the necrotic portion varies, usually the destruction corresponds to that shown in Fig. 4, but it is not very rare that it has reached or even taken hold of the superficial muscular layer. However deep the necrosis has spread, a fairly homogeneous structure emerges so that the original components are no longer recognizable.

Usually this necrosis is demarcated by an arcuate line whose apex points inward into the skin. Below this lie considerable accumulations of polynuclear leucocytes, which penetrate also into the deeper parts of the necrotic masses. The depth of this leukocyte infiltration varies. Where the necrosis is only superficial, as in Fig. 4, it usually extends only into the superficial muscular layer, the connective tissue layer separating the latter from the deeper ones becoming of considerable width from much swelling, and showing numerous invaded polynuclear leucocytes. If the necrosis extends deeper, this connective tissue may also have shrunk, but then infiltration of polynuclear leukocytes into the deeper muscles occurs.

Two and three days after exposure, the preparations generally show approximately the same proportions, so that they can be described together.

The loosening of the deeper layers, where the epithelium is preserved, has decreased somewhat, so that the subepithelial layer often has almost the same width as in normal preparations. On the other hand, both the leukocyte infiltration and the vasodilatation are just as significant as before. The former often form limited foci.

The superficial muscular layer shows for the most part the same texture already known, but numerous cross-sections of fibers are encountered, showing a peculiar gray color. It is also noteworthy that often smaller parts of this layer can show very small changes, which mainly result in a fragmentation into smaller bundles and

and one

a focal leukocyte infiltration.

The connective tissue between the superficial and deeper layers of muscle is only rarely of normal width, but is usually so swollen that it exceeds the covering layers in thickness. Again, the same contains a lot of leukocytes.

Single accumulations of polynuclear leukocytes are also found in the deeper muscles.

The superficial necrotic portions are mostly shed and in the process of acquiring a new layer of epithelium. The deeper ones detach from the base,

This dissolution occurs in the area of the leukocyte wall, which separates them from the non-necrotic environment. The leukocyte infiltration extends into the latter to varying extents.

Four days after exposure, the signs of regeneration are already dominating the picture. The edema has almost completely disappeared from the subepithelial layer and has also decreased in the deeper connective tissue layer. The vessels still show signs of stasis, but contain few polynuclear leukocytes. The endothelium is of normal regularity. The infiltration with polynuclear leucocytes, so striking in the earlier preparations, has become far less.

In the superficial muscle layer, the previously scattered muscle fibers have come together again

figure 5

closed. However, only a few of these show a normal brown colour, the majority are gray in colour. Similarly discolored ones often appear in the deeper layers.

The untinged cuts no longer show superficial areas colored red. On the other hand, there are many depressions on the surface, some of which are already covered with epithelium, some of which have been preserved from the surrounding area, where mitoses are to be found as a sign of active new formation.

Even in the deepest necroses, where the defect has extended to the muscles, the subepithelial connective tissue pushes forward from the sides with the epithelium and thus partially fills up the substance losses.

It is peculiar that in the two cases which were available to me from this point in time, only very few hairy papillae and sebaceous glands were found. On the other hand, remnants of the same can very often be found, which appear as light to dark brown lumps, provided with a lumen, and standing in connection with the epithelium. Between them and the immediate environment one usually encounters large gaps.

Six days after exposure, the regeneration process has progressed significantly, but is not yet complete. Unfortunately, older material was not available to me

If we exclude the deepest and most extensive necrosis, Fig. 8, the sections again show a continuous epithelial covering. Polynuclear leukocytes appear only in the vicinity of the necrosis, either in clusters or diffusely.

Here one can also see that the connective tissue, which lies between the superficial and the deeper muscle layer, contributes to the filling of the substance loss that has occurred when the former has perished, Fig. 8.

It is striking, however, that this connective tissue growing up towards the base of the defect does not assume the same color as usual, but an almost pure brown.

Where no loss of substance has occurred, the edema has completely disappeared. The subepithelial connective tissue has returned to its original state almost everywhere. Swollen fibers are still occasionally found. Polynuclear leukocytes have become rare.

But it's the muscles that attract the most interest. In the superficial muscle layer, the gray colored bundles have partly disappeared completely, partly their cross-section has become significantly smaller than in Figs. 6 and 7, which show normal coloring disappearance of the edema and infiltration a real superficial layer reappears.

Similar changes also occur in the deeper layers, Figs. 6 and 7. They extend to different extents, but always show the same character. Numerous muscle fibers are separated from each other by a relatively large amount of connective tissue and have a very small cross-section, the color is sometimes the normal brown, but more often a gray tone predominates on the narrow fibers. In the middle of the fibers there is often a very large core, the shape of which changes greatly.

Here, as in all other places, the vessels show no trace of dilatation or hyperemia. The leucocytes lying in them also correspond to completely normal conditions, as does the condition of the endothelium.

The multiply exposed material actually showed only an increase in the processes described above, as also shown in FIGS. 9 and 10.

It should be emphasized that everywhere the epithelium was reduced to a thin, darkly colored layer where it was not entirely absent. Where necrosis proceeding from the surface was not encountered, not only deep infiltration was found, but also a uniform, superficial accumulation of leukocytes lying just below the epithelial remains

The edema in the subepithelial tissue was very marked and always accompanied by a heavy infiltration of polynuclear leukocytes. The vasodilatation along with the large mass of leukocytes within the vessels was also noticeable.

Sebaceous glands and hair follicles had changed and shrunk so much that they were difficult to see.

Where superficial necrosis occurred, abscess-like accumulations of polynuclear leukocytes were always found beneath it, Fig. 10.

The reaction always extended deep into the deep muscles as well.

The presentation just given of the microscopic observations on the material obtained by the experimental arrangement described above shows that the long wavelength rays used produce in tissues which have been sensitized by erytrosine a peculiar process which leads to the destruction of tissue components .

Described in a context, it runs approximately as follows:

Within the first 12 hours, if the sensitizing solution has not hit the epidermis superficially, edema appears at the exposed site, which gradually increases to have reached its peak about 24 hours after exposure. By this time the vessels have dilated significantly and contain strikingly large masses of polynuclear leukocytes. The vascular endothelium is damaged, numerous leukocytes migrate into the surrounding area. The subepithelial tissue, although previously passed by the rays, is scarcely damaged under these circumstances, while the underlying muscles do not seem to possess nearly the same power of resistance. The muscle bundles present here break up into individual fibrils and for the most part perish, while in the course of the process a strong infiltration of polynuclear leukocytes occurs between them. This can become so severe that miliary accumulations, most likely equivalent to miliary abscesses, develop.

Hair follicles and sebaceous glands are also damaged and show signs of incipient necrosis, although these changes are not common.

In a relatively short time, on the fourth day, regeneration begins. The vessels contract again and the numerous leukocytes that have migrated gradually disappear. The muscles, which have been broken up into individual fibers lying far apart from one another, close together again, provided the fibers have not perished. But among the fibers that have been preserved there are many which, by their peculiar coloring and small cross-section, mark themselves as doomed to perish. It takes a long time before all the damaged muscle fibers disappear. Six days after exposure, many damaged ones are still encountered, although otherwise the process appears complete.

If the exposure is renewed before the action of the preceding one is complete, it increases the quantity of the changes, it being particularly noticeable that hair follicles and sebaceous glands now perish in abundance, while their surroundings are occupied by a copious infiltration of polynuclear leucocytes. The epithelium is also severely damaged.

If, however, the epithelium was also sensitized from the surface, while the subcutaneous injection of the erytrosine solution sensitized the deeper layers, necrotic shrinkages extending to different depths developed in these places under the influence of the light. Gradually, around these necroses, polynuclear leukocytes accumulate in abundance, with the help of which the necrotic piece detaches from the environment to be shed. Both connective tissue and epithelium then proliferate into the defect from the sides thereof, so that it is at least partially filled during regeneration. The healing of smaller losses of substance can be completed in a very short time, but larger necroses have only just detached on the sixth day and show the first signs of filling the defect.

If one tries to distinguish between the primary and the secondary occurrences in this process, it becomes clear that the light rays effective in the experiments have a necrotizing effect. However, it is doubtful whether the observed vasodilatation should be included here - endothelial destruction can be observed - they are primary symptoms in any case.

Even under normal conditions, that is, when all the rays act together on unsensitized organs, the light affects the vascular system in a special, hitherto unexplained way. As FINSEN 1) observed long before, vasodilatation occurs in places that have been exposed to intense light even after a long time if they are mechanically stimulated.

The necrotizing effect does not only appear on the surface, but is also noticeable at a relatively great depth, as shown by the muscle destruction that is always observed. The connective tissue possesses a fairly high power of resistance to this, unless the protective epithelial covering has also been sensitized from the surface, while more differentiated tissue components, such as muscles and glands, are more easily damaged. It may be emphasized that the numerous nerves traversing the area exposed in these experiments did not appear altered. However, the related method of investigation was unsuitable for demonstrating finer changes.

As a secondary consequence of these two primary phenomena, vasodilatation and necrosis, the strong emigration of polynuclear leukocytes, which completely dominates certain stages, must be considered. Here my results differ from those obtained without prior sensitization with concentrated light in that, strangely enough, no diapedesis of erythrocytes or even haemorrhages were observed. HALBERSTAEDTER has also under similar Ver

I) FINSEN, Nye Undersögelser over Lysets Indwirkning paa Huden. Medd. from FINSENS med. Lys Institutes, I, 1899.

a slight diapedesis of erythrocytes was observed.

This strong emigration of leukocytes is certainly made possible to a large extent by the vascular lesion mentioned, but it must also be associated with a chemotactic effect during the necrosis of the substances that have formed, since it is particularly directed against the areas where necrosis has taken place.

The importance of the leucocytes is probably partly that they contribute to the removal of dead tissue by absorbing them, but it is also likely that they have a liquefying and loosening effect on the tissues. This is supported by the fact that the superficial necroses are separating from the environment precisely in the area of the surrounding leukocyte wall.

Helsingfors, November 8, 1904.

V

Treatment (light treatment) of lupus

conjunctivae').

Of

KKK Lundsgaard.

Among the 1250 different lupus patients treated at Finsen's Medical Light Institute up to January 1, 1905, i had lupus conjunctivae ɔ: this complication occurred in 0.88 percent of the cases.

Without entering into a discussion of the clinical aspect of the condition, it will only be emphasized that it is somewhat different from primary conjunctival tuberculosis; While this is particularly characterized by impure ulcerations with a tendency to propagation and sowing of nodules, as well as what appears to be a constant attack on the lymph glands in front of the ear, the former usually forms very clean wounds, covered with heavy granulation masses and papillary excretions, which appear to be of a more benign nature, in that they do not have the great tendency to spread rapidly, although there is no or even less tendency to heal is. In addition, lupus conjunctivae probably never or almost never occurs with glandular growth; in any case, this complication did not occur in the 11 cases mentioned.

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1) Excerpt from a treatise on Tuberculosis conjunctivae, which appeared in the Hospitalstidende.

Without going into the question of the difficulty in the accurate diagnosis of tuberculosis conjunctivae in general, it will only be mentioned here that it is, in a sense, most difficult in lupus. Tissue microscopy is scarcely as characteristic here as in primary tuberculosis, animal experiments are very often unsuccessful, the bacilli are more difficult to detect, probably because they occur in smaller numbers and often in a degenerated form that is not easily susceptible to color; the other diagnostic tools, e.g. B. the tuberculin sample is not particularly suitable for examination. However, these diagnostic tools should play a lesser role in conjunctival lupus than in primary conjunctival tuberculosis, for there should be a probability bordering on certainty that a conjunctival condition in a lupus patient which has the appearance of lupus is in fact is.

In the cases referred to below, microscopy is necessary for various reasons, only in 7 of

11 cases, but I consider the diagnosis to be certain in the other cases. In none of the cases was it possible to find bacilli, and one of the two animal experiments carried out (vaccination in camera ant.) was negative.

The etiology of the disease, since it has nothing to do with this work, will only be touched upon in relation to one point. Naturally, infection of the conjunctiva in lupus patients must seem quite understandable, although this mucous membrane is quite resistant to tuberculosis infection; however, it is a question of whether it does not play an important role in the development of the infection in the lacrimal duct disease that occurs so frequently. This is directly conceivable only if the blenorrhoea occurring in the patient can usually be ascribed to tuberculosis in the lacrimal sac transplanted from the nasal cavity. Getting this checked is very important; For if this is the case, it will follow that these afflictions are never to be treated by splitting, special introduction and washing out, but always radically with extirpation of the sac. I hope to be able to contribute to the solution of this question when the opportunity arises.

It is very difficult, on the basis of what has been reported in the literature, to form a concept of how lupus conjunctivae is most correctly to be treated; the difficulty lies partly in the fact that, as a rule, no distinction has been made between lupus conjunctivae and primary conjunctival tuberculosis when therapy has been discussed, and partly in the fact that the number of published cases of lupus is very small.

It does seem certain that lupus conjunctivae has no tendency to spontaneous healing, and drug therapy does not seem to be of any great importance either; Of the treatment methods used to date, the surgical operation is to be regarded as the most reliable from the outset, besides this there are various others worthy of mention; however, as I shall show later, light treatment is superior to all other methods.

if

In going through the various treatments below, it is of course my intention to try to draw the results partly from the authors' statements and partly from my own experience, but as is in the nature of the matter, I must do the last become the most important. It is not possible to draw purely schematic therapeutic conclusions from numbers; reported e.g. For example, the statistic that excision cures a greater number of cases than other treatments does not mean that excision is a better treatment than other treatments in all cases; for it is likely to be assumed that the cases treated with excision were less widespread, since in the opposite case excision would not have been indicated. To this must be added, as already mentioned, that the cases discussed in the literature tend to focus on primary conjunctival tuberculosis, and although the results in respect of this may of course be used, lupus conjunctivae will require a different view to be asserted in respect of certain points . I will cite just one example: may the tuberculin treatment advocated by V. HIPPEL in primary conjunctival tuberculosis be as excellent as he claims, in lupus the risk of its use will, as a rule, be found to be too great, considering the danger which doubtless exists for the sowing of the tuberculous process.

We now proceed to a discussion of each of the modalities of treatment which may be considered, first discussing:

The surgical treatment. This consists in excising the diseased tissue, scraping it out, or destroying it with platina caudens or caustics. Excision and scraping are also commonly used followed by cauterization.

If one examines the result of these treatment methods in the literature, then it speaks highly for their excellence. SALIE") has collected 50 cases of conjunctival tuberculosis, in 30 of them excision was made, possibly with subsequent cauterization, and of these 22 were cured, 7 improved and in 1 the condition worsened. In one case, wedge-shaped excision in the thickness of the entire eyelid was made , and healed as a result, but there was a partial stance shift.

My own experience agrees well with this. Apart from three cases of primary conjunctival tuberculosis cured exclusively or chiefly in this way, the same is true of patient no. 5, 7 and 8 (lower eyelid) have been the case; these three cases belonged to the papillary form of the disease, the treatment of which appears to be particularly gratifying, which must be considered probable in advance, on account of its good demarcation and favorable form for removal. Cases of primary conjunctival tuberculosis have shown me that other forms (flat ulcerative) can also be cured by excision.

In the cases where I have achieved less good results with the excision, this is certainly due to the fact that it was not done with the necessary care and thoroughness, because I was not aware of its excellence and because I was not aware of it that with excision reinplantation of the tuberculosis in the surgical wound could easily take place 5: one should therefore not carry out the removal with scissors, since this instrument often goes uncertainly in the desired direction, but always with a knife, and the excision should be in one

1) H. SALIE: On the success of tuberculin treatment, dissertation Göttingen 1902.

2) That patient no. 87 later received widespread lupus conjunctivae has nothing to do with the first lupous excretion. The healing of this was controlled by observation in almost 3 months, and the later lupus ocular process clearly arose from the spread of the skin lupus over to the conjunctiva.

a few millimeters from the edge of the diseased part; If the knife becomes infected during the operation, you should stop working with it and use another knife. Thus done, I believe that excision will in most cases give an excellent result, and I therefore think that it ought to be the universal method in all cases where the tuberculosis process is no more extensive than it can be excised. can be performed without causing disfiguration and the other inconveniences that can occur when the eyelid changes position.

If the question is asked whether cauterization should follow the excision, I will answer that, insofar as the excision is well performed, I regard this not only as unnecessary, but also as inexpedient. For, as I shall show later, cauterization is scarcely capable of accomplishing much, unless it is used extraordinarily energetically, and in such cases it causes not a little irritation, and, in the case of scar formation, it is easy to change position.

A number of writers have opted for curette scraping rather than excision; this method certainly also has its indication in cases where it is not easy to deal with, suffering because of the great

man

Large or multiplicity of the process to be treated by excision. Of SALIE's cases, eight are treated with scraping, six of these have been cured, one has apparently been cured, and one ended in enucleation of the eye. Personally, I have not had the opportunity to experience this therapy, which does not appeal to me, but the numbers speak for it, but I could easily think of cases where I would resort to it, but I would then have cauterization follow to mitigate the consequences prevent reinplantation.

With regard to the remaining surgical treatment methods, it will not be easy to find a guideline for their performance from the literature because the number of reported cases is too small. However, from what I have seen, I believe that therapy with platina caudens, which

should be regarded as very rational from the outset, cannot achieve great things, and probably should not be used at all in the usual forms of lupus conjunctivae. In only one case (9) did I achieve healing with this treatment alone; only after it had been continued for a month by energetically extended cauterizations, which were undertaken at two days' intervals, did the process seem cured; nevertheless, recurrence arose, which required 14 days of vigorous treatment to be cured. Considering now that the case in question would be cured considerably more quickly by excision and without so much inconvenience to the patient, I do not think that the method is to be recommended in cases that are not very extensive, and in other inoperable cases the proportions are less favourable , insofar as cauterization does not seem to help in the slightest, simply because vigorous cauterization, which is a prerequisite for obtaining communications a. Finsens Medical Light Institute. X

of a result is impossible. I refer to Case 1 as particularly instructive: a patient treated intermittently for 4-5 years with cauterization without healing, indeed without any result whatsoever.

In my opinion, therefore, cauterization has only a small, limited indication, I believe that in certain cases something can be achieved with it against the sowing of miliary granule nodules, at least I think I have seen this in a case of primary conjunctival tuberculosis, but the condition for one Effective only if one has patience in treating each of these granules with ignipuncture. If one wishes to use the method in other cases (when the process is more widespread), then ignipuncture is of no use, only in the case of deep, energetic surface burns it is possible to obtain a result in such a case.

Leaving aside the cauterization with Platina candens, as far as the other caustic treatments are concerned, I will only deal for a moment with the lapis stick treatment. This is certainly still used, but there is not much literature to assess it; SALIE has three cases in his work, regarding one he reports that the patient died of phthisis pulmonum, regarding the other two that they were not improved, and one patient died of meningitis. That the method is not good seems to me to follow from the results obtained with the platina caudens etching. For a long time I treated one of my cases of primary conjunctival tuberculosis with a lapis pencil without any result, and judging by everything I am inclined to believe that the method can be considered worthless, perhaps harmful.

ver

Passing now to the discussion of other methods, I will dwell briefly on the freezing method with chloroethyl, as I have used it in some cases. It seemed natural, here in Denmark, where it seemed for a time that this treatment would give good results against lupus and partly against cancer, to try it in conjunctival tuberculosis; this then prompted me to do it. The application is not difficult on the everted eyelid, the globe can be easily protected, possibly covered with cotton wool; However, I don't want to delve into all this, since the method obviously has no value at all; I only mention her because she is found listed in the medical records. and because I may be able to prevent others from wasting their own time and that of patients in experiments of this kind. One will find chlorethylated cases in Nos. 1, 4, and 8; perhaps this seems to bring about some improvement, but there can be no question of a cure, nor of an aggravation such as has been seen on the skin with chloroethyl treatment in lupus.

I then proceed to discuss a purely chemical, drug-based treatment: the formalin method, as developed by Dr. BEHM from Stockholm in a lecture at the second Nordic ophthalmological meeting in Copenhagen in 1901?). In the discussion following a day's lecture by JACKSON 2) BURNETT recommended formalin treatment in conjunction with scraping at about the same time as this.

1) Hosp. Tid. 1903 p. 735 and Nordisk Tidsskrift f. Therapy 1903.

2) Americas. associate Section of aphtalm. opt. record. 1903 p. 417 Ref. Nagel's annual report.

As soon as I became acquainted with Behm's report, which seemed very convincing to me, I immediately began to treat my patients by this method. BEHM's results were ideal in that he had cured all the cases at his disposal: four conjunctival tuberculosis and one case of tuberculous uveitis with parenchymatous keratitis.

The treatment consists partly in subconjunctival injection of a solution of formalin 1:500 or 1:1000, partly in atomization and spraying of a solution of one part ether and three parts formalin solution (1:150) in all 10 cc; while this was done on the everted eyelid, the cornea was protected with a rubber membrane.

As mentioned, I immediately tried the method and tested it in a large number of cases: in all six cases of conjunctival lupus (1, 3, 4, 5, 6 and 8) and one case of primary conjunctival tuberculosis. I began with subconjunctival injections first, as far as possible, brushing the conjunctiva with formalin at the same time. At first it looked in one case as if the condition had improved significantly. The patient complained of severe pain during the treatment, but she had been suffering for so long that she was so embarrassed that she honestly endured it. One fine day it seemed to me that the improvement stopped and we got no further and then seemed to get worse; but this was perhaps only apparent because my confidence in the treatment had been shaken and both the patient and I had become pessimistic.

However, the formalin treatment in a second patient (No. 3) resulted rather in an aggravation, the process spread further and nodules formed around the same, and in patient No. 4 there was improvement and apparent healing when rubbed in; however, later recurrence; this case, however, is that where formalin treatment has given the best result; for that case 5 was cured after cutting off the peduncle process and treating its base with formalin is of little importance, as the pedicled polypoid tuberculous formations are very benign, and may be cured by simple removal, as in case no. 8 (lower eyelid) shows. So, with the best will in the world, you can fall no. 5 do not count in favor of treatment, especially since case no. 6 (stalked), was not healed after cutting off and applying formalin, presumably because of insufficient radical removal.

After abandoning the formalin method based on the above experiences, I was made aware that I had modified BEHMS' method instead of blindly following it and that this might be the cause of the poor results.

I therefore decided to try again exactly as BEHMS instructed, and fortunately I had a case of primary conjunctival tuberculosis and one of lupus conjunctivae (8, uppermost eyelid) under treatment right then, and these I used. I sprayed them exactly as BEHM indicated and the solution he recommended (ether and formalin 1:150); the technique was fairly easy, but I found it difficult to get the ether mixed with the formalin by constant shaking during the treatment. The result was no better than when I tried it the first time (after an improvement there was a recurrence), but the treatment hardly hurt. I finally tried one at the end

different kind of formalin, but consistently with the same result, and then gave up the cases which were later treated in a different way; as well as the 2 treated first, they were cured with light.

If one now asks where the explanation for the discrepancy between BEHMS and my results lies, I do not think that it is so difficult to find the same; I am certain that I only know of BEHM's case reports from a short presentation, but as far as I have been able to check he used excision and scraping prior to the formalin treatment and this may have hit the nail on the head.

Let's briefly review his cases:

1. 11 year old. Girl who first had a lachrymal fistula, which is here disregarded with regard to the result of the treatment, as nothing certain is known of its tuberculous nature.

In one recurrence on the uppermost eyelid, the granulations were scraped off with a sharp curette, followed by 21 formalin treatments.

2. 22 years. girl with tuberculous conjunctival tuberculosis of 10 ores; diagnosis was verified by vaccination on rabbits (how much is excised?) Cured after 7 formalin treatments.

3. 19 year old. Girls with lupus conjunctivae in the form of cockscombs, these are removed, which, as mentioned, is probably sufficient treatment for this form. After repeated injections healed

4. 46 years. Worker with lupus and 2 lentil-sized hard nodules on external commissure. They have been excised; healing after three formalin treatments.

So if case no. 2, where it is not clear from the report whether a radical removal was carried out before the formalin treatment, such is certainly carried out in the other cases, and I feel convinced that this removal is the main reason for the healing of the really mild cases has been. So, in my opinion, BEHM's communication is further proof of how excellent the results of surgical treatment are, but I do not believe in any appreciable importance of formalin treatment alone.

With regard to the other methods of treatment, we will omit tuberculin treatment here, since this will hardly be indicated in patients with extensive tuberculous diseases, and since we are speaking here exclusively of the treatment of conjunctival tuberculosis in patients with skin lupus.

Treatment with X-rays should just be mentioned, as STEPHENSON claims to have cured a case; It was a 4-year-old child who had numerous granulations and superficial excretions on the conjunctiva and regional glandular masses. Bacilli were detected by microscopy of excised pieces and animal experiments gave positive results. - Séances with X-rays, each of 10 minutes, the process of scarring was healed. This is the first case treated in this way, and certainly the only one that can be found in the literature to date.

In conclusion, I discuss the treatment which has given me the best results in extensive cases where operative treatment has failed, and on which I have therefore placed the greatest confidence: the light treatment.

The fact that it took so long before FINSENS medical light institute agreed to use them on the conjunctiva

after 13

to try, although ulceration on the skin of the eyelid and the margin of the eyelid have long been treated in this way, lies in the difficulty which had to be assumed in advance as connected with the application and in fear of unpleasant side effects on the part of the eye and the reaction , which could be the result of applying strong concentrated light to the eyelid.

As for the technique, it never occurred to me from the start that it could be as easy as experience has shown. I thought to myself that, in order to reach the goal at all, one had to construct special instruments that combined the forceps, by means of which the eyelid could be everted, with a pressure glass. The instrument maker of the institute, Mr. WARBERG, therefore made me an instrument that was made from Desmarres ring tweezers by using a small circular pressure glass with crystal windows instead of the ring

cm

diameter was attached; Inlet and outlet pipes for the cold water were attached along one leg of the tweezers, which incidentally ended in a spoon handle, which made it possible to hold them. The instrument was reasonably easy to apply, but it was painful and slid easily; the longest usage time was 7 minutes, which is not enough. To prevent slipping I had the plate in which one leg ends fluted; I certainly achieved something by this, but not enough, as the smooth, slightly convex clear crystal window slipped easily.

It then occurred to me that chalazion forceps could be used to evert and hold the eyelid, and against the plate of the forceps it ought to be possible

approx.

be to press one of the ordinary pressure glasses. Meanwhile it was necessary to remove the uppermost part of the ring of the forceps, since otherwise the blood could not be squeezed out of the conjunctiva with the pressure glass. After various tests, a pair of tweezers designed by STADFELDT proved to be the one whose shape was best suited to my purpose, and I had the uppermost part of the ring removed from one of these, so that it became fork-shaped instead of ring-shaped. The application, however, thereby proved somewhat more difficult, and it caused the patient considerable pain to have them lying down; there was no question of it being endurable for the duration of a séance.

Under all this, working with Senior Physician FORCHHAMMER and a couple of interested female assistants, I came to try the following! I simply everted the eyelid, placed an ordinary pressure glass against it, and pressed it against the bony rim of the orbit, which was done very easily and with no visible gene to the patient. It immediately turned out that in this way it was very easy to get to the conjunctiva of the lowest eyelid and even to reach the transitional fold; the uppermost eyelid also presented no great difficulty, as the thickened lupus process, from which it was hard and stiff, enabled the evertation to be repaired just as high as the process went, as the evertation was not in the thickened part could proceed; in other words, it has been found that lupous infiltrated eyelids may be everted more, and everting may be significantly higher than in a normal one.

Having thus turned the eyelid, the eye was well covered with hydrophilic cotton-wool moistened with water, and a small piece of cardboard; the light treatment could now begin and be continued for 1---2 hours per séance without genes of importance.

like , and the patient did not feel any significant pain from the reaction in the following days. This reaction was always clear, but in relation to that occurring on the skin during light treatment , peculiarly mild in character and course, there was some swelling and injection and usually a thin pseudomembrane, but the reaction proceeded surprisingly quickly: within 5-6 days.

So the violent reaction I had feared did not occur, it looked and the relationship is probably as if the soft mucous membrane could accommodate the tumor better than the stiff skin, and as if it were swelling too much Exudation of serous fluid withdrawn.

In any case, it seems to me from what I have seen that mucous membranes tolerate light reaction significantly better than skin, also I believe that light treatment is more effective for mucosal than skin conditions.

Under the treatment, literally speaking, the diseased process "melted" away and the patient felt a significant subjective improvement, particularly surprising was the result in patient No. 11, where, just to investigate what the treatment could do, I refrained from surgical Clear the protruding excretions remove. After a few treatments, the conjunctiva became completely smooth.

The light treatment was carried out on three patients (eight eyelids), one of them (No. 1) had had his disease for five years and was treated with caudal platinum, formalin, and chloroethyl without the slightest result. After 19 light treatments on one (both lids) and six on the other eye, the latter was completely healed as far as could be seen and the other, where the process had been very extensive, was completely healed except for a pea-sized area . This had to be excised because the pressure glass could not be attached due to shrinkage of the conjunctival sac; this shrinking was not greater than that it was in no way disfigured and prevented the movement of the eye. and in any case significantly less than one might expect from the extent of the suffering. Observation 4' months after the last light treatment and 3/4 months after the excision showed complete healing of the disease on all three eyelids.

The second patient (No. 3) had had his condition (on three eyelids) for about 1 year and had been treated with formalin with no result. Light treatment (6, 6 and 10 treatments) cured the process with minor symblepharon and ectropion.

The third patient (No. u) came under light treatment immediately after arrival at the institute. The case was of such magnitude that a second therapy could hardly have been used effectively, healing occurred through 9 light treatments on the left and 7 on the right eyelid, each treatment lasting one hour (but the first treatment [left eye] lasted two hours).

The fourth patient (No. 6) had had his disease for two years, he had been treated several times with excision, which, however, was hardly sufficiently radical; in any case, recurrence arose.

When the light treatment began, the affliction was so widespread that extirpation was impossible. seven be. actions made the suffering go away completely.

With regard to primary conjunctival tuberculosis, my experience of the value of light treatment is small, having used it on a young patient; she received three light treatments of 1-2 hours duration, endured

, they well, and significant improvement in the exposed spots appeared undoubtedly; the treatment was, however, given up, as tuberculin treatment seemed indicated to me because of attack of the conjunctiva bulbi. Finally, with my above-mentioned Klemmer pressure glass, I treated a suspect portion in a patient whose tuberculosis had been cured almost otherwise; but the séance lasted only seven minutes (since the glass was sliding); I just want to say that despite the short time there was a visible reaction.

So it is now proven: palpebral conjunctiva endures very well even long-lasting light treatment, the reaction is even in its whole appearance and course significantly more appealing than the reaction on the skin, and the reactive inflammation seems to be even more effective than here; Lupus conjunctivae is cured excellently and in a short time by this method, and simple evertation without the aid of instruments permits the treatment to reach almost to the fold of the fold.

I am not yet able to comment on the circumstances under which treatment is possible, but I am prepared that everting of the eyelid will not occur in all cases and that the shrinkage that occurs during treatment as a result of the healing process may in some cases Circumstances will make it difficult to finish the treatment with light is indicated in the case above, but this is of no further importance, since in such a case one can end with excision of the small remaining part.

It would be of interest to try the treatment of other conjunctival diseases in this way, above all trachoma, perhaps the application here would cause greater difficulties; but it is not impossible that, by means of a prismatic pressure glass placed under the eyelid, one could get the light thrown against the conjunctival surface without everting it, since the light is turned against it by a total reflection. Of course, one may encounter unexpected difficulties in attempting to do this; but as the problem, if solved, would also be of the greatest importance for the treatment of other mucous membrane diseases (mouth, nose), it is well worth trying, and I hope to have the opportunity of expressing myself on it later. I also hope that I will have the opportunity to make experiments on how trachoma behaves towards light treatment.

In concluding on the therapy of lupus conjunctivae, I highlight as a result:

1. Unless the ailment is more extensive than radical extirpation is possible a few millimeters outside the margin in healthy tissue, this treatment is to be used.

2. If the process is more extensive or if there are recurrences after extirpation, light treatment should be used, which seems to be the only safe method of curing inoperable cases.

3. Platina caudens, scraping, etc., should be auxiliary, not main methods').

medical reports.

In reviewing the medical reports mentioned, I remark that I am absolutely aware of the great deficiencies of the journals on many points. This is due to a number of special circumstances over which I could not control.

What was recorded in the journals of the institute about the eye cases was not initially intended for publication, some of it is of an old date, it was partly written by different people, since the ophthalmologist of the institute only has a patient under daily personal treatment under special circumstances, Otherwise, however, the treatment is only checked by a weekly visit to the institute. Only after interest in

1) If the lupous process has spread to the conjunctiva bulbi, this will cause special difficulties. Treatment of tuberculin is scarcely advisable in the case of lupus patients, and all that can be done here is to try to cure it by extirpation, scraping, and cauterization. I am not allowed to comment on the extent to which one may venture under certain circumstances to attach concentrated light to the sclera. I only want to mention here that I made this experiment on a rabbit in a few short séances without seeing any bad results, and that patient no. 6 was accidentally exposed to conjunctiva sclera, so that a clear reaction arose without any unpleasant consequences. the light treatment of the eye cases was awakened, more careful journals are written, and more careful subs

· made searches; quite apart from this, however, all cases which have been under treatment at all are mentioned in the following.

If, when looking through it, one thinks that the therapy is somewhat restless and changing, then this is from a period when the treatment was probing and it had to be, since the literature did not give any specific guidelines and experience was not yet sufficient to be able to lead.

If the journals sometimes appear to have been broken off at long intervals, this is usually due to the fact that the patient has been at home.

29

MJH, born 1882, seamstress, per Silkeborg,

Lupus vulgaris (faciei et colli, cavi nasi, gingivae, palati duri et mollis [perforatio palati duri]). Seq. gonitis tuberculous. dextri. Blennorrhoea sacci lacrymalis. Lupus conjunctivae palpebralis sup. and information i.e. and information s.

Treated with platina caudens, formalin douche and chloroethyl freezing for about 5 years without any result. light treatment. Cure.

From the Journal of the Light Institute is attached:

12 1899. On Conjunctiva palpebralis sup. i.e. There is a pea-sized lupus nodule with an ulcerated surface.

Platina candens. 29/8 1900. Blennorrhoea sacci lacrymalis d. On the upper palpebral conjunctiva of the right eye one sees a scar the size of a penny with a few fresh granules; it has been treated many times with platina candens (how often it is not stated).

11, 1900. Along the upper transitional fold and on the right palpebral conjunctiva sup. part of the granules can be seen. 25), 1900.

Multiple granulations on the eyelid.

cont. Platina candens. 21/, 1901.

She was repeatedly cauterized until 4/12/1900 when she was traveling home. Today she returns. On the

temporal part of the conjunctival surface of the upper right eyelid one observes another ulcerated granulating surface, which with

Platina candens is cauterized.

12/10 1903. Patient has been treated consistently for long periods with platina candens, but the disease has nevertheless steadily spread significantly. Now the whole inside of the upper right eyelid has changed into a nodular granulated mass, here and there heavily granular on the surface. On the inside of the lower right eyelid, a granulated area almost 10 öre in size, devoid of conjunctiva, is observed. The conjunctiva bulbi is normal, the cornea is not affected by inflammation, but there is a small ambiguity. No swelling of the preauricular gland.

formalin treatment. This is done every second to third day for more than two months, sometimes the affected areas were brushed with a ten percent solution, sometimes a one percent solution was injected subconjunctivally according to Behm. At first the condition seemed to improve somewhat with this treatment, but perhaps this was only due to a partial necrosis of the tissue, later it was found that the granulations again grew more profusely than before.

man

1904. After repeated unsuccessful attempts to achieve improvement through treatment, the possibility of a cure was long abandoned. The trial was of such magnitude that excision was impossible;

should perhaps have attempted a scraping, but the patient had become very unwilling to accept further treatment because of the formalin treatments, which were extremely painful for her. In the fall of 1904

freezing with chloroethyl four times without result; however, the treatment was well endured and not particularly painful.

1905. The inside of the right eyelid is transformed into a granular mass, as previously described. Conjunctiva palpebralis inf. i.e. is the seat of a penny-sized granulated wound surface.

1914

On the inside of the left lower eyelid is a pea-sized ulcerated area with an unclean clumpy granulated wound surface. No swelling of the preauricular gland on the left side.

light treatment. Patient received a total of six light treatments on the left eye and 19 on the right eye. The condition improves greatly, the treatment has not visibly hurt, the eye is somewhat sensitive to it, the reaction lasts five to six days, and the eyesight is not in the least bit embarrassed.

Now the wound on the left side has completely disappeared. The process on the right side is healed with the conjunctiva bright and specular except for a small area about the size of a pea in the center of the inside of both eyelids.

Patient should go home.

15/5 Conjunctiva palpebralis sup. i.e. is naturally specular everywhere. The lid is somewhat thickened; in the inner half is a small symblepharon, which does not prevent the movement of the eye.

On the inferior palpebral conjunctiva. i.e. a pea-sized granulated area approximately in the middle, otherwise the conjunctiva is naturally specular, the lid is also somewhat thickened here.

Nothing abnormal in left eye.

Although the remaining portion of the right eye was far enough from the transitional crease to be easily revealed by everting, it was not possible to get the pressure glass attached because of the tension created during the healing process, and since the Klemmer pressure glass could hurt, looked back and forth from the light treatment regarding the remaining part cocaine anesthesia

the diseased tissue was excised.

Thereafter

Cauterization with platina caudens. If the patient now goes home cured of her eye condition, it must, of course, be admitted that recurrence is possible; should it occur in the right eye, it would not be unthinkable that the cause of a new infection was the inflamed, probably tuberculosis, lacrimal sac, and I would then be inclined to extirpate it at once. There is only one reason why this did not happen: Messages a. Finsens Medical Light Institute.

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in that the patient did not suffer from embarrassing symptoms of it and therefore finds it difficult to understand that such an operative intervention is necessary. Patient should travel home”).

No. 2.

MKJ born 1841, married m. Huefner pr. Ebeltoft. Lupus vulgaris (faciei, colli, manus s., cavi nasi) Ectropion Lupus conjunctivae palpebralis inf. i.e.

Treated with Platina caudens.

From the Journal of the Institute is added: 12/2 1903. Patient has a 2 cm deep ectropion on the lower lid of the right eye. Lupus on right cheek extends up to the edge of the eyelid, and just below it is seen in the temporal half of the conjunctiva a good pea-sized, kidney-shaped, superficial ulceration with an impurely granulated base.

Platina candens. Patient last visited the institute on 29/6 1905. Her skin ailment is of such magnitude that it must be considered incurable. Small wounds can still be seen on the ectropionized eyelid as a continuation of the skin wounds. Treatment of the eye condition is considered useless under these circumstances.

No. 3

AML, born 1873, unmarried pr. Fredericia.

Lupus vulgaris faciei. Lupus conjunctivae palpelbralis inf. uo

Treated with formalin without improvement. Light treatment healing.

2 1904. There is a pea-sized, hard ulceration on the inner sides of both left eyelids and on that of the right one

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1) 24/ 1905. She returns and comes to my place for observation. Lupus conjunctivae is nowhere to be found. Conjunctiva palpabralis sup. i.e. is blank all over, reflective, the lid is somewhat thickened, but is slightly everted. Incidentally, the situation is as mentioned earlier: an insignificant symblepharon inwards, on the lower right eyelid, but the pathological process took place here. Subjectively, the patient notices a significant change, there is no longer a strong discharge of pus, which also affected vision, but only a little tearing (see tear duct disease). /12 05. Obser. vation. No recurrence.

taken.

lower eyelid. Her seat is on the lower lids near Canth. int., after the carunculae to. Nothing to squeeze from the tear duct.

Korea clear. No swelling of the preauricular gland.

Microscopy of an excised piece: Typical tuberculosis: elementary tubercles, giant cells, necrosis, no bacilli.

19. Formalin treatment. This is done partly with a brush, partly with a subconjunctival injection, a total of 8 times with an interval of 2-3 days

It was very painful and did not improve the condition; on the contrary, the ulcerations seemed to increase and suspicious nodules formed around the circumference.

17/3 Light treatment on conjunctiva. 19/4: After four light treatments, the ulcerations on the lower eyelids were almost healed.

29/4 The patient received two more light treatments (six in total), after which the affection on the upper eyelid was almost healed.

travels home 1/6 comes back. The conjunctival disorder seems to have healed. She goes home again. 1/3 1904.

No recurrence. 24/10. A small suspect stain on l. lower eyelid.

Light treatment (7). 15%, in 1905 she writes that the eye is fine. 17/2 1905.

surveillance A small suspect area on the mucous membrane of the lower left eyelid in Canthus int. Under

Cocaine anesthesia this is excised and applied to a guinea pig in camera ant. inserted, followed for four months, inserted absorbed, no response.

Light treatment (8 and 9 [each two séances]).

20/3 Another suspect fleek.

Light treatment (10 [two séances]).

9/. Now slight ectropion on the lower eyelid of both

Eyes. A small, string-shaped one is observed on the left

Symblepharon in canthus int. Ulceration nowhere.

In November 1905 the patient was again observed. No recurrence, conjunctiva smooth and reflective everywhere.

man

No. 4.

KP, born 1882, servant, Thy.

Lupus vulgaris (nasi, palpebrae sup. gingivae, palati faucium cavi nasi) Lupus conjunctivae palpebratis sup. i.e.

Treated with galvanocaustic, formalin, chloroethyl; some improvement, not cure.

%5 1903. Patient has had blenorrhea of right lacrimal sac for a few years. Now some pus can be squeezed out of it.

Weber-Bowmann's operation.

Rinsing of the lacrimal sac. The inside of the upper right eyelid is coarsely granulated, here and there superficially ulcerated and cicatriculated. No swelling of the preauricular gland.

cocaine anesthesia. Excision of a piece for microscopy. Microscopy: Typical tuberculosis: elementary tubercles, giant cells, not bacilli.

galvano-caustic. 8/10 The treatment improved the condition only to a small degree. Vigorous rubbing of formalin (1:100) once

weekly. 5/12 Formalin treatment continued. The ulcerations have improved and healed except for a pinhead-sized area. The granulations partially blurred.

Sep Formalin pt 11/12. The ulceration is larger.

formalin embrocation. This was continued for three weeks when the ulcerations appeared to have healed. 28, 1904.

Patient comes for observation. One now finds a pea-sized granulated area on the inside of the upper right eyelid.

Freezing with chloroethyl. This treatment is continued for 14 days, which makes the wound smaller but not healed.

5/1 1905. Another small ulceration on the conjunctiva of the right upper eyelid.

No. 5.

ASJF, born 1889. T. an expedient.

Lupus vulgaris nasi (cavi nasi). Lupus conjunctivae palpebralis inf. and 0

Treatment: cutting off the stalked tumors, formalin treatment of the wound floor; Cure.

16/7 1903. On both conjunctivae palpebralis inf. and 0. one finds granulation tumors about the size of a pea, one on each. Blennorrhoea sacci lacrymalis and 0. No swelling of the preauricular gland.

cocaine anesthesia. The tumors are cut off. The removed tumors were sent for microscopy; but unfortunately there was never an answer about the failure of the same.

30. Small ulcerations can now be found where the tumor used to be; these are brushed with formalin 1:100 once a week.

576. The conjunctival process is cured.

Patient died on October 22, 1904.

No. 6.

KA, born 1850, married m. Huefner, Jylland.

Lupus vulgaris nasi and cavi nasi. Lupus conjunctivae palp. information sin.

Treatment: excision, formalin, recurrence. clipping. Final result unknown.

177, 1903. In the left lower fornix conjunctivae one finds a cock-shaped granulation tumor.

cocaine anesthesia. Removal with curved scissors. Formaline rub 1:100. 1/4 1904. The granulation tumor has recurred.

cocaine anesthesia. clipping. 5/10 05.

After being at home for over a year, the patient is returning today. Her doctor treated her with excision and lapis etching last summer. Now the conjunctiva palpebralis inf. i.e. covered throughout its extent with condyle-like excretions, reaching the edge of the eyelids. In the middle one observes a pea-sized impure, pus-covered wound and several cicatrice threads go from the process to the conjunctiva bulbi,

cocaine anesthesia.

Excision of a small piece for microscopy.

Microscopy: The tissue is built like tuberculosis, many giant cells, no bacilli.

6/10 light treatment. In this case, the accident occurred that the bulbus was not sufficiently protected, which is why, among other things, a part of the conjunctiva bulbi larger than the size of a pea was exposed and resulted in a clear reaction (the séance lasted 45 minutes), but without causing any damage.

11/,. Light treatment (No. 2) for 60 minutes.

21/10 (No. 3) 55 minutes. 28/10 (No. 4) 55 minutes.

3/1 (No. 5) 124 minutes. 11/11 (No. 6) 60 minutes. lu (No. 7) 25 minutes.

After that the patient was cured; Excretions gone, wound healed, conjunctiva smooth with cicatrice threads.

No. 7.

MT, born 1887, daughter of a shoemaker, Zeeland.

Lupus vulgaris faciei, cavi nasi, labii utriusq. Lupus conjunctivae palpebralis sup. s.

Treatment: clipping. Cure.

1901 one finds noted in the journal: Ceratitis phlycthanularis 1.0. Downward on 1st cornea a pinhead-sized ulcer.

cocaine anesthesia.

Microscopy of the excised piece revealed typical tuberculosis: elementary tubercles, giant cells, necrosis; not bakeries.

2/2 1904 observation. No remnant of the tuberculous tumor. The ulcerations of the edges of the eyelids present as a continuation of the skin tuberculosis.

8/6 1905. Patient has been under eye treatment for a year. Extensive impure clerations are now observed on the conjunctivae; these are certainly a result of the spread of the process on the skin, since they can pass from it as a continuation inwards via the mucous membrane to both eyelids; how far upwards they go is difficult to decide, since the eyelids have shrunk greatly as a result of a cicatricial process and are therefore difficult to evert. On the left bulbous conjunctiva there is a pea-sized, irregular ulceration close to the limbus corneae. There is a highly vascularized disseminated keratitis (pannus) on the cornea. on r. Corneal stains and vascularization.

No. 8th.

PCJ, born 1870 unmarried seamstress, Langeland.

Lupus vulgaris (nasi, genae, cavi nasi, manus). Strictura canalis lactymalis. Lupus conjunctivae.

1. Palpebralis sup. i.e. (ulcer).

Treatment: Excision and formalin treatment without healing, but with significant improvement, followed by chlorethyl treatment and, since complete healing did not occur, platina caudens.

Healing 2nd Palpebralis inf. i.e. (condyloma-like excretion). Treatment: clipping, healing.

1975 1904 Patient has a pea-sized granulated area close to the edge on the inside of the middle of the right upper eyelid, clumpy in circumference, conjunctiva is natural by the way.

A pea-sized, stalked, condyloma-like excretion on the inside of the right lower eyelid. No swelling of the preauricular gland. Patient complains of tears from the right eye. No secretion to squeeze out of the tear duct. When water is injected through the superior canaliculi. .

cocaine anesthesia.

Weber-Bowmann's operation.

Section of the stalked tumor.

Microscopy: Typical tuberculosis. Bacilli will not

proven (Blad).

Formalindouche 1:200 on upper eyelid.

30% The patient has now received four formalin douches with no effect.

cocaine anesthesia.

Excision (of the ulcer) with scissors and forceps.

cont.

formalindouche. 4/7 The wound on the upper eyelid seems to be healing

to be.

1/7 While the patient used to have pain, this has now completely disappeared. The condyloma-like formation has hardly been completely removed, remains of its base are behind.

13

97. The wound on the upper eyelid healing well.

11/7 The wound is as good as healed, patient has now received eight formalin treatments.

The base of the condyloma-like formation on the lower eyelid is excised.

cocaine anesthesia. 16/7 Both wounds are now as good as healed, the one on the top eyelid is very suspect with small granules in the scar. 19/7 Pat. has today

Formalin treatment no. Got 10, but the wound on the upper eyelid recurred.

22/7 Sep formalin. Rp. Chloroethyl freezing.

10% The condition on the lower eyelid has not recurred. Patient received daily chloroethyl treatment on the upper eyelid until 18/7, then every other day to date throughout the 13th month

This has improved in that the wound is smaller than the size of a lentil.

12/3 Cauterization with platina caudens. 20/10 Patient is cauterized quite vigorously 6-7 times. Wound healed but a small suspicious stain is left.

travels home 1974 1905 Observation. Complete healing, solid scar, smooth and completely soothing.

6/ 1905. Patient complains of tears from the right eye, nothing can be squeezed out of the tear duct.

8th.

No. 9.

ASO, born 1890, daughter of a cooper.

Lupus vulgaris (genae, colli, cavi nasi, gingivae). Lupus conjunctivae palpebralis sup. i.e.

Treatment: vigorous cauterization with Platina caudens. cure

She comes for treatment for photophobia and lacrimation from the right eye, blepharitis and a small peripheral corneal infiltrate are found. In the center of the inside of the uppermost eyelid is a pea-sized granulated area that is greasy in appearance and clumpy on the surface. No swelling of the preauricular gland.

Under

Cocaine anesthesia is excised a small distance to microscopy. Microscopy: Typical tuberculous tissue with numerous giant cells, epitheloid cells and round cells. Tubercle bacilli cannot be detected (H. JANSEN). 12/ 1905. Energetic starts today

Cauterization with platina caudens. This was continued for a month with intervals of 1-2 days, the whole area being fired with a rather coarse platinum wire. After this all the diseased tissue seemed to have been destroyed, and the process healed with scar; however, after about 14 days, granulation masses shot out in a ring, corresponding to the edge of the original wound,

1/3 Cauterization.

20/3 The wound healed.

20/4 The wound stays healed.

4/5 No recurrence.

No. 10

20

JMN, born 1865, married m. Kaufmann, Norway.

Lupus vulgaris (faciei, coli, nasi, cavi nasi, labii, gingivae, palati duri).

Lupus conjunctivae palpebralis sup. 0 and

Treatment: Light treatment started at FINSENS Medical Light Institute, continued in Kristiana.

29/2 1905. Patient has two pea-sized areas of granulation on the inside of the upper lid of the left eye, close to Canthus int. No swelling of the preauricular gland.

light treatment. After two treatments, the patient traveled home to continue treatment in Kristiana.

No. II.

KMM, born 1877, married m. worker, Sonderjylland.

Lupus vulgaris (nasi, labii sup., cavi nasi, gingivae, laryngis).

Lupus conjunctivae palpebralis sup. U 0

light treatment. Cure.

4s 1905 10 years ago she had "glands in her eyes". Now and then she has had this disease, most recently last year because she was being treated in Hadersleben. The last few years her eyes have been particularly bad. Well both upper eyelids appear swollen and red, and there is some secretion of conjunctivae.Blepharitis quite severe.conjunctiva bulbi slightly injected.

The inner surfaces of both upper eyelids are covered with granulating nodular masses, which stand out like a cockscomb here and there, especially on the right side. Only on the left side is a small part of the conjunctiva free inwards. The process extends up to the envelope fold. Carunculae is free.

Nothing abnormal on conjunctiva bulbi.

Some spots on both cornea; slight vascularization of the left cornea.

No swelling of the preauricular gland.

The skin of the eyelids is free.

cocaine anesthesia.

Cutting off an excess on microscopy.

Microscopy: Many elementary tubercles and giant cells, no necrosis, no bacilli (H. JANSEN).

6/5 Light treatment (two hours) on left eyelid.

75. Light treatment (one hour).

° /5. Under

cocaine anesthesia

Cutting off the excretion od is introduced onto a rabbit in Camera aut.

87. Patient has had six light treatments on the left eye (five of one hour and one of two hours) and four on the right eye.

Underneath, the conjunctival disorder is very significantly improved, the conjunctiva on both sides are mostly smooth, excretions are only seen here and there. The treatment is only slightly uncomfortable, the reaction is moderate and lasts about a week.

Patient has now received 9 + 7 treatments. The mucosa of both upper eyelids is smooth with cicatricial streaks, some tension of the lids, no change in position.

1/6 1905. No recurrence.

1, 1905.

no relapse,

(The vaccinated rabbit got iris tuberculosis.)

7

9

VI.

The Effect of Radium Rays on chymosin solutions. (Second notice.)

Of

Sigval Schmidt-Nielsen.

As I reported in the previous volume of this communication, even the most powerful preparations of radium exert only a very slight weakening effect on chymosin solutions. I took this effect as a secondary one, produced by ultraviolet rays produced by Luminiscens ?) on the inner surface of the experimental vessel.

Since one can raise the objection to the experimental arrangement used in the first experiments, that the reaction did not have time to assert itself, since the amount of chymosin was determined by means of coagulation experiments immediately after the end of the irradiation, I have made a series of new investigations carried out, where the samples were observed retrospectively for 12 weeks. This was to determine whether this kind of chemical action of the radium rays behaved in the same way as the biological one, which becomes noticeable only after a certain period of time.

1) In Message I, Phosphorescens is incorrect.

However, this could not be shown, since the small, reliably demonstrable destruction that occurred after the end of the irradiation did not increase during a period of three months.

A chymosin solution prepared with glycerine was used in all experiments in order to avoid an annoying bacterial effect. From this, 10 cc were exposed to the action of 0.1 g of the same radium preparation (intensity 1,800,000) under the same experimental arrangement as in my earlier experiments. After exposure, the samples were kept dark. The coagulation times were determined with 0.1 ccm enzyme solution against 10 ccm freshly milked goat's milk at 37°.

The experimental design was the same for all determinations down to the last detail.

Experiment I. The chymosin solution was exposed for 16 hours on May 4-5, 1904.

exposed for 16 hours. On June 1, the two control samples showed a mean coagulation time of 9'/min, while that of the exposed was 103/1. On July and July the coagulation times for the control sample and the irradiated sample averaged 83/100 and 9 9/10 min.; on July 30 12 3/4 and 13 3/4 respectively.

Experiment II. From May 5th to 6th, 1904, the chymosin solution was exposed for 22 hours. The mean coagulation time was found on June 1 to be 9'/4 min for the control sample and 10 1/2 min for the irradiated sample. On June 18, the corresponding values were 11%0 and 123/10 min; on July 11th 8 3/4 and 9 6/10 min. and finally on July 30th 12 3/4 and 16 min.

Trial III. The exposure of the chymosin solution lasted from the 7th

until

1904

in the

whole 92 hours. On June 1st, a mean coagulation time of 9 '/4 min. for the control sample and 13 min.

10

I May

for the irradiated sample. On June 18th the same values were 11% and 14 3/4 min. respectively, on July 11th 8% and 13 1/4 min., finally on July 30th 12 3/4 and 19 min.

In experiment IV with a chymosin solution exposed for 53 hours from May 11 to 13, 1904, on June 1 the control sample showed a coagulation time of 9 1/4 minutes and the irradiated sample 113 minutes; on June 18 the coagulation times were u %10 and 16 min, on July 11 8 3/4 and u min, on July 30 1 2 3/4 and 161/4 min.

All of the coagulation values reported in these experiments represent the mean of 5 to 12 individual determinations. The irregularities in the average values on different days are partly due to the fact that the milk could not be the same, which is also evident from the control values.

Considered as a whole, one sees that despite the long-term irradiation with a powerful preparation and subsequent storage of the sample, it was not possible to demonstrate a significant difference between the milk-coagulating ability of the irradiated and non-irradiated samples. I have not been able to prove any after-effects.

Finally, in connection with my earlier communication, I would like to emphasize from my test protocols that of the almost 100 determinations on irradiated chymosin solutions discussed above, only one showed a lower value than the control determinations, of which more than 40 were not exposed at the same time samples were carried out.

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vii

Some experiences about the usability

# of light as a reagent.

Of

Sigval Schmidt-Nielsen.

One of FINSEN's favorite ideas was that light should be used as a reagent in various laboratories. Of course, he was thinking in particular of the concentrated electric carbon arc light he had introduced to medicine, with which it was possible to treat clear, colorless and transparent media with large amounts of radiant energy.

If, when studying the chemical effects of light, it is not only important (as a class reagent) to decide whether or not a body or a system is photostable, one cannot be satisfied with the qualitative relationships, but must also demand quantitative information. Only when this succeeds can light be placed with advantage in the series of reagents.

As is apparent from my study of the inactivation of chymosin, chymosinogen, and antichymosin (in these communications, IX, pp. 199-232), it seems as if no constant or consistent results could be expected from the use of the concentrated carbon-arc electric light. However, after I continued the investigations in the summer of 1904 and in doing so became aware of a number of sources of error that should not be neglected and received a large amount of test material, things turned out differently than I expected.

My recent investigations into the inactivation of chymosin solutions in concentrated light are far from sufficient to settle the question of its usefulness as a reagent; elementary experiments of a physical nature are missing. However, since I am unable to continue the investigations in the near future and they may claim a little interest in the "light work", I have decided to publish the results despite my doubts.

The investigations fall into two parts, namely, firstly, the question of the accuracy to be achieved in inactivation experiments carried out in a uniform manner, secondly, whether a masked heat effect can be ruled out in my experimental arrangement.

1. Variations and experimental error in inactive.

Fourth of chymosin solutions. If one considers, as I did in the previous work [1]*) p. 212, the changes in the coagulation time of the exposed samples, one will see in a comparison between parallel tests carried out under exactly the same test conditions that these despite the originally same coagulation time but in one case is io times as great as in another. However, if one draws the conclusion from this that the effect or, to put it more correctly, the amount of chemically active rays absorbed in the test chamber was also 10 times greater , this is not permissible. This is because the coagulation times cannot be taken directly as a measure of the light effect that has taken place; they can only be a means of calculating how much enzyme is still left in unchanged, active form, and thus how much of the original (in and of itself quite unknown and indeterminable) amount of enzyme has been inactivated by the light.

1) These brackets refer to the bibliography at the end.

In Tables I and II I have compiled some experiments from the summer of 1903 (1) p. 211 and 212).

Table I:

Coagulation time for 0.1 cc
Chymosin Solution and 10cc Inactivated Chymosin
goat milk

percentage of unexposed sample exposed original amount sample

in 15 mins

deviation from

Average

Coagulation time for 0.1 cc
Chymosin Solution and 10cc Inactivated Chymosin
cow milk

in percent of the unexposed sample exposed original amount

Sample in 15 mins

deviation from

Average

0

One and the same aqueous chymosin solution was exposed to a spot of light from a 50 volt, 50 ampere lamp for 15 min. As far as the test details are concerned, reference is made to [1] p. 203 uf. The coagulation times in Table I relate to goat's milk, while those in Table II relate to cow's milk.

It can be seen that the deviation of the individual determinations from the arithmetic mean is from • 13.5 to + 20, ie from ; has been 17.6% to +26.6%. The average error for an individual determination, calculated using the least squares method, is a maximum of +18.05% according to the tests in Table I1) and +16.37% according to the tests in Table II. The mean error can be calculated for both series together by making the two series uniform, and a more reliable value is obtained. It is then † 16.33%, ie an agreement between parallel determinations that must be described as absolutely unsatisfactory for theoretical investigations.

The results of the experiments continued in the summer of 1904 were quite different. Table III shows firstly that exposure to light for 15 minutes inactivated an average of 95.3% of the original amount of enzyme, while according to Tables I and II under the same conditions only 75.6% was inactivated. This improvement in effect is undoubtedly due to the cleanliness of the concentrating apparatus. An important role is played by the water, which is filled in its lower part in an amount of 1350 cc. I will not go into detail here about the particularly unsatisfactory results which I got at the beginning, before I became aware of this source of error, only to state that I got a much weaker inactivation with the apparatus in the laboratory than with those in the clinic. In the laboratory, without my knowledge, the distilled water was filtered through paper by the servant, while this never happened in the clinic, and this seems to be the cause.

I) F

$\Sigma \Delta 2$ _

if n is the number of determinations and A is the

n=1 deviation from the arithmetic mean number.

Messages from Finsen's medical light institute. X8

After I became aware of this and after every care was taken to keep the apparatus clean, all experiments showed a much stronger inactivation than in 1903 with similar solutions and experimental arrangements. If one considers that the light in the concentrating apparatus has to pass through a layer of water of 30 cm, one can easily imagine that the water need not contain a large quantity of suspended impurities before it has a significant influence on the quantity of the ultra-violet rays just effective .

In Table III I have compiled 22 experiments carried out in the laboratory with one and the same lamp. It should be emphasized that all of these tests are carried out with as few errors as possible and that the sources of error are reduced to a minimum. The exposures only took place when, after about an hour, the lamp was burning steadily without any noticeable changes on the voltmeter and ammeter. The concentration apparatus was meticulously cleaned just before the experiment, and fresh distilled water was poured into both its upper and lower parts. Immediately after exposure , the coagulation tests were carried out with freshly milked goat's milk. According to all experiences, the chymosin is particularly against

Table III:

deviation

from average

coagulation time for

0.1 cc chymosin-inactivated

solution and 10 cc chymosin in

Attempt:

Goat milk percent of

Original sample

unexposed

clears

Crowd

test

in 15 minutes: No. 5 20% 1904. Two Be

9 min clearings one after the other

575

500 mins

98.2%

98.4%

+ 2.9 + 3.1

small traces of alkali sensitive; in my test series, in accordance with the experiences of Dr. medical th MADSEN (oral communication) can state that the alkali of the ordinary

to

sample tube is sufficient to prevent agreement between replicates. I have attempted to overcome this disadvantage partly by using only test tubes made of hard glass which had been boiled with distilled water for a long time, and partly by measuring the enzyme solution only at the beginning of the coagulation experiment. Also, I used a larger quantity of enzyme solutions for each experiment. While previously always 0.1

ccm ccm milk was used, I have now made a coagulation test with 0.5 ccm and as a control with 0.1 ccm for each sample, both with 10 ccm milk. If the latter showed a coagulation time 5 times longer than that carried out at the same time with 0.5 ccm, the experiments were accepted, otherwise not. The coagulation times listed in Table III and in Tables IV-VI relate to 0.1 ccm enzyme solution for 10 ccm milk; they represent the values found for 0.5 cc multiplied by 5, with the 0.1 cc value serving only as a control.

Apart from a higher, average inactivation (95.3%), it is equally striking from Table III that the individual tests show smaller deviations from the mean than was the case in Tables I and II, namely; 6.1 to +3.7, or from : 6.4 to +3.9%. The mean error for a single determination calculated using the least squares method is as favorable as +2.840 (against 16!).

Experiments carried out in the clinic of the Light Institute, under exactly the same experimental arrangement and with the same precautionary rules, are even more advantageous. In these experiments, the entire "handling" of both the lamp and the concentration apparatus was done

one of the most capable and most experienced assistants in the clinic. The results are summarized in Table IV.

Table IV:

No. 26 B 8/4 1904. Seven

Hours after cleaning 6 min 180 min

96.7% F.S. apparatus. Two Be

230

97.4% consecutive clearings

Average 96.4% inactivation.

+ 0.3 + 1.0

0

Here we have an average inactivation of 96.4% and a deviation of : 3.1 to + 2.5 or expressed as a percentage of = 3.2 to + 2.6%. The mean experimental error for a single determination is calculated to be +2.24%.

Table V, p. 118 gives an impression of the importance of the state of cleanliness of the apparatus. The test conditions etc. are the same as for the tests of Tables III and IV with the exception that the concentration apparatus, as indicated by the table text, had not been cleaned for a day or more.

The average inactivation has dropped to 91.3", and the mean error for a single attempt has increased slightly to +3.13%.

This behavior is even clearer from Table VI, p. 119. The experiments reported there were carried out with the laboratory lamp under exactly the same experimental conditions as the III-IV series, except that the water had been removed from the lower part of the concentrator.

Considering the table as a whole, the average inactivation has reached so high a value as vol" that the mean least-squares error has become as small as 10.61".

As above, but with water 76 llin.) (150 min.) (96.0) in the lower part

(160

(96.3)%

is. With this test arrangement it was possible to achieve a satisfactory agreement.

From the details of Table VI, the numbers in italics may claim special interest; namely, they represent tests carried out subsequently after the addition of water, and thus constitute direct evidence of the influence of the same on the inactivation.

*) These attempts (printed in italics) are not included in the calculation.

The percentage of inactivation achieved when removing the water is not significantly increased, which was not to be expected given the arrangement made, which in any case has major effects. Emphasis must be placed on removing the water from the lower part of the concentrating apparatus, as is clearly evident from the tables, to achieve a very substantial increase in accuracy.

2. The lighting effect is not masked

heat effect. Using a lamp of 50 volts and 50 amps, a thermometer placed in the "light point" of a 12.5 cm finsen apparatus gets a temperature of about 200! It is therefore quite natural that some authors doubt that it is possible to protect the medium against a deleterious effect of heat by dousing it with water .

As far as the effect on tissues is concerned and in clinical treatment, the question will be dealt with by JANSEN [2] in a subsequent issue of these communications. He finds that, in contrast to SCHOLZ (3), one can secure a pure light effect.In the summer of 1904, I was able to confirm this by means of thermoelectric measurements on living rabbits.

With regard to the exposure of my plane-parallel, cylindrical test chambers filled with a clear translucent liquid, it should be mentioned that the effect on chymosin disappears completely when a glass plate is switched on in front of the test chamber. This gives direct proof that it cannot be a question of a thermal effect. In fact, the ultraviolet rays are absorbed by the glass, while the heat rays penetrate the test chamber. Here, however, these are prevented by the water-cooling from developing their effect on the clymosin solution, and this is just as effective after the experiment as before.

It may, however, be thought that other media are more sensitive to the action of heat than the chymosin solutions, and it is in any case interesting to know the temperature of the experimental liquid during exposure, and I have therefore made some experiments on this subject. When I was busy with this in the summer of 1904, a work by JODLBAUER and TAPPEINER [4] appeared. These authors measure the temperatures in the test chambers I specified [1]. However, since their measurements are carried out with the help of thermometers immersed in test chambers, they have only a limited value, partly because the thermometer bulb makes up too large a mass in relation to the 1 cc content of the test chamber, and also because it is struck by the rays, must give completely wrong (too high) values.

In my experiments I have tried to minimize these sources of error by using thermoelectric measurements. My thermocouple consisted of two 0.18mm thick copper wires soldered together with a nickeline wire also 0.18mm thick. A strip of tinfoil, 1 mm wide, was glued to the front of the test chamber so that the thermocouple, ie the soldering point of the same, should not be hit directly by the rays. The circulation brought about by the trickling of water and the small part of the test liquid which remains in the shadow throughout the beer allow the temperature thus measured, which I will call shadow temperature in the following, to be regarded as the actual temperature of the medium at any moment.

there .

About the arrangement, it should also be mentioned that the second pole (soldering point!) of the thermocouple was placed in the cooling water so that the temperature increase that occurred could be read directly on the galvanometer. Each division on the same represented 0.6°C. For comparison and control, I also made a series of temperature measurements where the thermocouple was exposed to the direct action of the rays. These values, which are given in the tables as "direct", must be higher, but because of the smallness of the element (at most 0.001 cc against 1 cc of liquid), if not absolutely certain, then at least much more correct than thermometer measurements.

Measurements in the standard 3.2 mm thick test chambers are given in Table VII.

man

As might be expected, the shadow temperature is less than the direct and greatest for the red liquids. But if one disregards the hemolyzed blood, the rise in temperature is very slight, and if cold cooling water is used, it is evident that in the case of clear, permeable media there can be no question of a warming effect, since the temperature then obtained is lower than the usual room temperature .

1) Equal parts ox blood and distilled water.

from

How such liquids behave that contain suspended solid particles cannot be determined directly, namely by comparing their mass, as emphasized by JODLBAUER and TAPPEINER (1.c.), with the intermediate liquid, usually (as, for example, in cultures of microbes) is too low to measurably increase the temperature of the latter. I have examined a couple of times the rise in temperature of freshly defibrinated ox-blood in the 3 mm chambers and never found more than 15°, usually a few degrees lower, i.e. a temperature of the liquid of 30°, which can scarcely be injurious to blood. It should be mentioned, however, that these measurements are uncertain, as blood pigment escapes during exposure and is chemically altered.

The maximum temperature is reached right at the beginning. I have followed the ascent to the same several times and as an example I will give an experiment with direct irradiation from the thermocouple in a 3.2 mm chamber filled with distilled water:

Accidental observations indicate that the temperature of the test liquid always fell when the lamp began to "talk". However, I have not been able to observe a simultaneous reduction in destruction; on the contrary, it was usually greater than expected in such cases.

0

maybe

In the usual arrangement, the temperature of a thermometer fixed in the spot of light where my test chambers were installed was determined as possibly 235°C. When the water was removed from the lower part of the concentrator, it rose to 325° C. With the particularly favorable results obtained by this arrangement, according to Table VI, it was desirable to ascertain whether an injurious heating effect was now taking place. It can be seen from Table VIII below that the rise in temperature was indeed greater, but, except for the hemolyzed blood, this should be insignificant.

In the case of blood and other strongly colored liquids, where a deleterious rise in temperature can be obtained (the limit for this must be very variable), this can be counteracted by making the test chamber shallower. Namely, while in a 3.2 mm chamber with hemolyzed ox blood, the direct Tempe

I) Equal parts ox blood and distilled water.

temperature 40.7 °C. and the shadow temperature 31.1°C. was, in a 1.5 mm chamber, the temperatures were 26.9 and 22.7°C, respectively. (the water temperature 15o C.). In another test, the temperatures in the 3.2 mm chamber were 41.9 and 32.5° C. against approx. 30 and 23.9° in the 1.5 mm chamber. So even here there is no dangerous temperature for the intermediate liquid.

The 3.2 mm chambers are preferable because of the larger content. However, their thickness, and thus their volume, cannot exceed a certain limit for clear and translucent media. Apart from the fact that it is not possible to guarantee safe exposure on the rear side, temperature increases also occur because the water cooling on the front side does not reach the rear when the chamber z. B. 12.8mm; I observed a temperature increase of 6.4° C at the front and 11.2° C at the back in one of these filled with distilled water.

One might have thought that the water in the concentrators could be advantageously replaced with glycerine. dr medical At my request, JANSEN, assistant at the institute, tried to fill the space between the front lens with this. A thermometer placed in the cone of light, when the water was removed from the lower part, did not show a lower temperature than when the front lens was filled with water. Since the front lens in this arrangement also shattered, which otherwise never happens with older lenses, these attempts were not continued.

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3. finish.

If it has been shown, after the foregoing experiments, that by using the concentrated electric carbon-arc light one can avoid the effect of heat, and that exposures carried out at different times under the same experimental conditions succeed in achieving an accuracy such as that found for the inactivation of chymosin solutions i 0, To reach 67 percent, this must be regarded as promising for continued chemical investigations.

All the more so since the chymosin does not represent an ideal experimental material and the accuracy found may well be regarded as a minimum. The determination of the initial coagulability of the solutions is in fact uncertain because of their insignificance in comparison with the length of the exposed samples. The percent inactivation taken as a measure of light intensity can therefore become too dependent on factors quite different from exposure itself than is based on initial coagulation time. However, this can be eliminated by a larger number of attempts.

Apart from the influence which the experimental material itself exerts on the accuracy achieved, there is another way of increasing it, and that is to use the two-divided chambers which I have described (in [1] p. 205). . In one of the completely identical parts, a control sample can always be exposed as a comparison sample at the same time as the one to be examined.

The accuracy which I have obtained in my experiments becomes even more favorable when compared with that obtained by other investigators in experiments made with sunlight. DUCLAUX (5) and SEBELIEN [6] found considerable differences between parallel experiments when oxalic acid solutions and EDER's liquid were exposed to light. I will not discuss these experiments in more detail, only point out that SEBELIEN obtained differences between parallel determinations when oxalic acid solutions were isolated uniformly, which cannot be explained as analytical errors, e.g. from 0 to 4.5%, from 11.7 to 44.10/0, from 37.6 to 63.2% oxalic acid burned. This agrees with DUCLAUX's experience that he got inexplicable differences with one and the same oxalic acid solution.

With EDER's liquid, SEBELIEN has the probable error for a series of parallel determinations

6% charged; for another much worse one, namely +27%. SEBELIEN rotated the entire test setup around one axis during the isolation and then calculated the error to be +6.5%. In any case, this is a much worse agreement than that found for the chymosin of = 0.67%

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Videnskabsselskabets Skrifter 1904, No. 9. Christiania 1904.

Apparatus and methods for light treatment

Of

Axel Reyn.

With 6 illustrations.

FINSEN has individually described the apparatus and the improvements made with it in various volumes of the communications from Finsen's medicinske Lysinstitut. However, a comprehensive description of the apparatuses which we now need has not been sent out by the institute and I will therefore briefly describe them in the following.

Since 1901, sun treatment has been completely replaced by treatment with electric light. First, the sun is a very unsafe source of light in our climate, but, in addition, a significantly faster response was felt in those treated with electric light alone than in those who had predominantly used sun treatment. The cause is to be found in the reduced amount of external, ultra-violet rays of the sun; these rays, abounding in electric light, do not penetrate deeply, but produce an important reaction on the skin, with profuse serous secretion and shedding of the epithelium, removing most of the pigment formed by the light. The skin thus retains its light color so that the light can continuously penetrate into the depths. This doesn't happen with sun treatment, where the reaction on the skin isn't nearly as significant. A very strong brownish pigmentation, perceptible to the naked eye, arises, which probably prevents the further action of the light, and unless the affection is cured in comparatively few séances, continued treatment is in vain.

The solar apparatuses have therefore not undergone any changes and do not require any further description.

The apparatus for collecting electric light is essentially of the same construction as FINSEN?) has described, but individual changes have taken place.

Because of the intense heat developed by the carbon arc light, the top lenses cracked very frequently.

By means of experiments I have carried out, it has been possible to remedy this by switching on a 1 cm thick layer of distilled water in the part of the apparatus which faces the lamp. The water layer is delimited on the side facing the light by a flat rock-crystal plate, and the second wall is formed by the flat side of a plano-convex converging lens.

The distilled water is very much heated by absorbing the heat rays of the light, and is therefore cooled by a stream of ordinary cold water circulating in a metal cap outside the rim of the lenses. In order to make the cooling surface as large as possible, this is extended upwards into a funnel. Due to the temperature difference between the water heated by the light and the water cooled down considerably in the metal cap, a constant circulation is created. Finsens Medical Light Institute. X

maintained by the distilled water between the lenses, so that the heated water keeps rising and the cooled water keeps sinking down, whereby the flat crystal plate facing the light is kept well chilled and therefore seldom cracks. (Whereas we used to need lenses for about 2000 kr. a year, we now need for about 200 kr.).

A considerable saving in electricity consumption is also obtained, since the apparatus can be brought closer to the light, which is consequently better utilised; we therefore now need 50-55 amperes instead of 70-80 as before.

Since the uppermost layer of water absorbs the greatest amount of heat rays from light, the large layer of water in the lowest part of the apparatus is heated less and the cooling cap surrounding it in the original apparatus has therefore been omitted.

As the drawing shows, the Finsenapparat consists of a plano-plane rock crystal plate, which is first exposed to the light, between this and the first refracting lens is the above-mentioned layer of water with the cooling cap, close to this is a plano-convex lens, which, together with the first, directs the diverging rays parallel light collected by two lenses in the lowest part of the apparatus to converge light. Between these two lowest lenses is a more extensive one

it be

layer of water to further absorb the heat?) before the light hits the patient. The lowermost part of the apparatus can be moved to the uppermost when it is necessary to apply the light spot. In the lowest suspension point of the apparatus there are three adjustment screws if the lamp changes its focal point slightly. The lowest part of the apparatus (where the light emerges) has a perforated metal lid?) so that the nurse can position the patient without being embarrassed by the strong light.

As shown in FIG. 1, the apparatus can be separated at various points for cleaning purposes. It is carried (see Figure 2) by an iron arm fastened to a ring, the ring carrying a total of four collectors around an electric carbon-arc lamp. The ring was originally fixed in the ceiling of the hall, which has several advantages, most notably that it frees up floor space. However, in the large treatment room in the new institute, this attachment had to be changed because the ceiling construction was too weak. That is why the ring is supported by an iron column embedded in the cement floor.

We have used various arc lamps over the years, but it is only in recent years that we have been able to get a well regulated, steady burning lamp at a cheap price. In the design of this lamp, several changes suggested by our own mechanic (Harald Petersen) have been of great importance.

In addition to the large Finsen apparatus, on which four patients are treated at the same time, we have constructed and used an apparatus for the treatment of a single patient, the Finsen-Reyn apparatus, at the institute.

The purpose of this apparatus was to enable the introduction of fins treatment to physicians who do not have the space or use for a larger installation.

It was therefore important that the apparatus could do approximately the same thing as the large Finsen apparatus with a lower amperage. It consists of a self-regulating projector lamp burning at 20 amps and a concentrator. As shown in Fig. 3, both the lamp and the concentrating apparatus are supported by an iron rod mounted on a tripod, so that they can be raised and lowered and rotated in the vertical and horizontal planes.

A projection lamp with slanting carbons is used for the apparatus, because the crater of the upper carbon, which supplies the most effective rays, can be formed forwards and downwards on such a lamp. If the concentrator is placed in front of the lamp, it will collect most of the rays. If, in addition, the collecting apparatus is hung very close to the lamp (at a distance of about 5 cm), the lighting effect achieved with this apparatus is almost as great as with the large Finsen apparatus. In order to ensure a constant correct position of the crater, an adjustment device is mounted on the arm which supports the top carbon holder, which can move the top carbon forwards or backwards during the burning of the lamp.

. The concentrator is mounted in a bracket in front of the lamp and can be moved horizontally and vertically.

As shown in Fig. 4, the light-collecting apparatus is built approximately like the Finsen apparatus. It is made shorter for practical reasons and is the most refractive lens

consists of a FRESNEL lens, as this utilizes the light significantly better than an ordinary lens when

the apparatus should be as close to the light source as here. The apparatus is provided with the same cooling device as the Finsen apparatus.

The principle of the pressure apparatus with water trickling designed by FINSEN has not changed. he consists

as shown in Fig. 5, consists of a flat rock crystal plate and a plano-convex rock crystal lens of different curvatures, set in a metal ring with an inlet and outlet pipe to the cooling water.

Over the years, pressure glasses of various shapes and sizes have been designed for specific purposes. One of Dr. LANG, St. Petersburg, constructed printing apparatus.

figure 6

As shown in Fig. 6, the inflow and outflow tubes are shaped like a handle and the pressure apparatus is so small that it can be inserted into the foremost part of the nasal cavity and similar places where the use of the ordinary pressure glass is impossible.

Recently, the ophthalmologist at the institute, Dr. LUNDSGAARD made experiments with prismatic pressure apparatuses, by which a change in the direction of the bundle of rays can be achieved, so that it can be directed to places where application of the light would otherwise not be possible.

It was no coincidence that FINSEN used a carbon arc lamp, for it was that of the commonly used artificial light sources which contained the most chemical light, but he thought that the method could be improved significantly, particularly with regard to the light, and he writes 2) : "Improvements in light will consist in creating a light which is as rich as possible in chemical rays and as poor as possible in heat rays." A number of attempts in this direction have therefore been made at the Institute over the years.

The first attempts were made by the engineer KJELDSEN, who tried to construct a mercury lamp, but it had such serious defects that it had to be abandoned without having made any experiments on patients. BANG 3) constructed his iron lamp, which was ingeniously thought out and we initially had great expectations of it as it seemed to meet the above requirements set by FINSEN. Unfortunately we were disappointed as we started trying to treat the patients. The metal spectra, with which Dr. BANG experiments are very rich in external ultraviolet rays, but these are not able to penetrate very deeply into the skin and the lamp has therefore not acquired any greater importance in patient treatment.

Gradually, with the spread of light treatment, a number of apparatuses and lamps were constructed to replace the expensive finning apparatus. One of the first is that of Prof. LORTET and Dr. GENOUD constructed in Lyon. The apparatus is a projector lamp, which is regulated by hand and burns at 12 amps. The patient is placed about 5 cm away from the lamp and treated with the same unconcentrated light. LORTET and GENOUD believed that they would get enough light in this way, but tests carried out at the institute showed that the effect was significantly weaker than with the Finsen apparatus, which can also be proven by calculation). This lamp was quite cheap and the first designed for individual treatment, which is why it quickly became popular. She prompted us to construct the FINSEN-REYN apparatus described above according to FINSENS principles; for we saw the necessity of accommodating the desire for a cheaper apparatus, if the reputation of the light treatment was not to be ruined by the use of too weak a light and the bad results produced thereby.

The dermo-lamp, which, as it seems, achieved quite a wide spread for a time, is manufactured in Berlin. It is constructed according to the BANGS principle with cooled metal electrodes and does not require any further discussion.

dr BROCA and CHATIN in Paris need an arc lamp in which the carbons are provided with an iron wick, but these are difficult to work with and they gave no better results with concentrated light than the ordinary SIMENS A. KOHLE, and the suggestion that It is therefore absolutely not advisable to use unconcentrated light from the same.

dr STREBEL in Munich has proposed various lamps to improve light treatment (iron-carbon, double-arc lamp, induction lamp), but none of them gives a light that meets the requirements we have set.

In short it can be said that no one has succeeded in constructing lamps or apparatus that

Finsenapparaten and of the light sources tested hitherto the carbon arc light is the best.

1900 published 5) Prof. v. TAPPEINER in Munich some experiments he had done with Paramecia. He showed that in certain solutions they were quickly killed when exposed to light.

DR. DREYER 6) at the institute here took up these experiments and transferred them to bacteria and animal tissue. He thought he could sensitize the latter to the otherwise ineffective but relatively strong penetrating rays. The first trials on patients in March-April 1903 failed because the treatment was very painful and resulted in a significant loss of substance, which is why the trials were discontinued so that DREYER could improve his method through laboratory trials. They were not resumed until September 1903. DREYER left the institute at about the same time, but published instructions for carrying out the treatment. This instruction was strictly followed, but the results were unfavorable, in spite of the fact that we tried various changes in the method *), and it is therefore abandoned in the institute here. At about the same time, DR. JESIONEK 9) in Munich made contact with Prof. v. TAPPEINER's suggestion of trying to smear eosin on canker sores and lupus and exposing them to sunlight or the unfocused light of an arc lamp thought to have beneficial effects. We attempted to replicate these experiments at the Institute by treating a number of patients with the weakly concentrated light of a 20 amp arc lamp or sunlight, but the results did not encourage continuation:

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9) dr JESIONEK: Munich med. Weekly 1904, no. 19, 22

figure explanation

2.

Fig. 1. Section through the unexposed skin.

Section through the skin 12 hours after exposure. 3. Cut through the skin 24 hours after exposure. 4. Section of superficial necrosis 24 hours after exposure. 5. Section of superficial necrosis 3 days after exposure. 6 & 7. Section through the skin 6 days after exposure. 8. Section of superficial necrosis 6 days after exposure. 9. Cut through the skin after repeated exposure.

Section of a superficial necrosis after repeated exposure.

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These "messages" will not be continued. Its ten issues will remain in the literature as a monument to FINSEN, as a testimony of what this man's initiative meant for the first 10 years of the institute's life in scientific and therapeutic terms.

The work that will come out of the Institute in the coming years will appear in domestic and foreign specialist journals, where, by their very nature, they belong best and where they can best be discussed.

Printed by A.schlacht, Jena.

Liljeroos gez Kolster: Studies on the action of certain light rays on sensitized tissue

Publisher von Gusta: Fis

by Fischer, Jena

Communications from Finsens Medicinske Lysinstitut (Finsens medizi

National Light Institute), Copenhagen. Edited by Prof. Dr. Niels R Finsen. Seventh Issue. With 4 plates. Price: 4 marks.

Contents. I. Investigations of the histological changes caused by the light treatment of lupus vulgaris. By E. Wanscher. the effects of electric arc light on tubercle bacilli in pure culture. By Sophus Bang. - III. Methods for measuring the bactericidal effect of light. By Valdemar Bie. IV. On the bactericidal action of ultraviolet rays. By Valdemar Bie. - V. The habituation of bacteria to exposure to light. By Valdemar Bie. VI. Studies on the effect of light on infusoria. (With 1 plate.) By Georges Dreyer. – VII. Sensitization of microorganisms and animal tissues. (With 3 plates.) By Georges Dreyer. VIII. Studies on the resistance of tumor cells to intense light. By CO Jensen and H. Jansen.

IX. Publication by Niels R. Finsen and his collaborators. July 1893 to July 1903.

Eighth Issue. With 8 illustrations in the text. Price: 4 marks.

Content: Light Biology. A representation of the effect of light on living organisms. By Gunni Busck.

Ninth Issue. With a portrait and 11 illustrations. Price: 7 Marks 50 Pf.

Content: Niels R. Finsen † By Gunni Busck. Is the bactericidal effect of light an oxidation process? By Valdemar Bie. With an image Is the bactericidal effect of light due to a direct effect on the bacteria or to an indirect effect through the development of a bactericidal substance in the culture medium? By Valdemar Bie. With an illustration. – The disinfecting effect of hydrogen peroxide, by Valdemar Bie. On the distribution of bactericidal rays in the spectrum of carbon arc light. By Sophus Bang. With 4 illustrations. - On the influence of light on animal tissue. By Georges Dreyer and Hans Jansen. On the pathogenesis of buckwheat rash. By Gunni Busck - The effects of concentrated electric arc light on chymosin, chymosinogen and antichymosin. By Sigval Schmidt-Nielsen. With 5 illustrations. – The effect of radiun rays on electric light. By Sigval Schmidt-Nielsen.

Fighting Lupus Vulgaris. from dr Niels R. Finsen, Prof.

in Copenhagen. Lecture at the autumn conference in the International Central Office for Combating Tuberculosis" in Berlin, 1902. With 24 tables and statistics on 800 cases treated with the light method. Price: 2 marks.

It is well known that Finsen's method has caused a stir in medical circles and its progress has been followed with great interest. The present compilation will therefore not only be of value for dermatologists and clinicians, but also every general practitioner who encounters cases of lupus in his practice will enjoy reading the small print. Wiener Kliniken Rundschau 1903, No. 32 of August 9th:

Finsen publishes impressive statistics from his Medicinske Lysinstitut in Copenhagen. In the course of seven years, 804 lupus patients were treated there with concentrated light. ... Vienna Clinical Weekly 1903, No. 12:

... For the doctor, the small brochure is of double interest. It gives statistics on the success of the light treatment on 800 lupus patients who were treated at the Copenhagen Institute from November 1895 to January 1, 1902. ...

Deaths from cancer in Wrocław in the years 1870-1900 with special reference to local influences on them

Illness. (From the Hygienic Institute in Breslau.) By Dr. medical F. Frief, former assistant at the institute. With 10 illustrations

in the text. "Abpr. ad Klin. Jahrb., Bd. XII.” Price: 2 marks 40 Pf. Handbook of pathogenic microorganisms. With the participation of Me

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D etailed brochures can be obtained from any bookshop.

Just published: supplementary volume. First issue. With 7 plates and 27 partially colored illustrations in the text. Price: 15 marks. Central Journal for Internal Medicine, No. 1 of January 3, 1903:

Ref. believes that the work will find a large and grateful readership as a reference book, especially in medical circles that are not specifically concerned with bacteriology. The individual microphotograms are so perfect that it is a pleasure to look at the instructive pictures. Manual of experimental pathology and pharmacology.

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- . Heart. - Chapter VIII. blood vessel system. IX. Chapter. lymphatic system. X. Chapter. Breathing. Microscopic tumor diagnosis. Practical guide to sub

search and assessment of the tissue growth occurring in the form of tumors. For students and doctors, especially specialists. By Prof. Dr. Friedrich Henke in Charlottenburg

Berlin. With 106 mostly color illustrations. Price: 14 marks, born 15 marks. Munich medical weekly of February 20, 1906:

As can be seen from the title, the work not only deals with the diagnosis of tumors in the narrower sense, but also with all tissue growths that occur in the form of tumors, such as e.g. B. in many inflammatory processes, especially the specific inflammations occur. It is precisely because of this that the book meets a practical need in an excellent way. The question of whether a given case is malignant

or whether it is just a tumorous tissue change due to syphilis or tuberculosis can often only be decided by a careful histological examination following a test excision, and the result of this examination is primarily the guidelines for therapeutic action.

An advantage in the treatment of the substance, which is also important for practice, is that the diagnosis does not only take into account the histological conditions in a one-sided manner, but also the macroscopic behavior of the material to be examined is always taken into account.

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dr Willy Mueller, owner and director of the physical-dietetic sanatorium Dorotheenbad-Gotha. Price: 2 marks 40 pf.

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